IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Reissue Application of:	Bill L. Davis and Jesse S. Williamson
Entitled:	COMBINED LITHOGRAPHIC/FLEXOGRAPHIC PRINTING APPARATUS AND PROCESS
For:	Reissue of U.S. Patent 5,630,363
Filed:	May 20, 1999
Serial No.:	09/315,796
Examiner:	Not Yet Assigned
Group Art Unit:	2854

SUPPLEMENTAL STATEMENT OF PRIOR ART AND OTHER INFORMATION

APPENDIX 3

III. Documents Pertinent to Series Commencing with United States Serial No. 08/538,123 filed October 2, 1995 issued as U.S. Patent No. 5,651,316 on July 29, 1997

Index No.	Description
22	U.S. Patent No. 5,651,316 entitled: Retractable Printing/Coating Unit Operable on the Plate and Blanket Cylinders Simultaneously From the Dampener Side of the First Printing Unit or Any Consecutive Printing Unit of Any Rotary Offset Printing Press, Issued on July 29, 1997 to Howard W. DeMoore, Ronald M. Rendleman and John W. Bird, Assignee: Howard W. DeMoore
23	U.S. Patent No. 3,397,675 entitled: Coating Apparatus, Issued on August 20, 1968 to John De Ligt, Assignee: West Virginia Pulp and Paper Company
24	U.S. Patent No. 3,433,155 entitled: Mechanism for Applying a Coating to a Plate, Issued on March 18, 1969 to Robert K. Norton, Assignee: Harris Intertype Corporation
25	U.S. Patent No. 3,768,438 entitled: Machine for Coating Sheets of Paper and the like with Liquid Coating Materials, Issued on October 30, 1973 to Wilhelm Kumpf

Index No.	Description
26	U.S. Patent No. 3,800,743 entitled: Materials Application Apparatus, Issued on April 2, 1974 to Raymond K. Egnaczak, Assignee: Xerox Corporation
27	U.S. Patent No. 3,916,824 entitled: Device for Coating Strip Material in Continuous Operation; Issued on November 4, 1975 to peter Knodel, Gerhard Mayer, Horst Munsterer and Reinbold Wagner, Assignee: Aluminum Norf GmbH
28	U.S. Patent No. 3,931,791 entitled: Mechanism for Applying Lacquers and the like on a Printing Press, Issued on January 13, 1976 to Friedrich Preuss and Kurt Difflipp, Assignee: Roland Offsetmaschinenfabrik Faber & Schleicher AG
29	U.S. Patent No. 4,222,325 entitled: Mounting Means for Movable Carriage on an Offset Press, Issued on September 16, 1980 to Robert Edwards, Assignee: White Consolidated Industries, Inc.
30	U.S. Patent No. 4,270,483 entitled: Printing Coater, Issued on June 2, 1981 to Denton G. Butler and Andrew W. Lester
31	U.S. Patent No. 4,372,244 entitled: Varnishing Units on Printing Presses, Issued on February 8, 1983 to Herbert Rebel, Assignee: M.A.N. - Roland Druckmaschinen AG
32	U.S. Patent No. 4,397,237 entitled: Roller Train Structure for Use with Printing Machine, Issued on August 9, 1983 to Manfred Makosch, Assignee: M.A.N.- Roland Druckmaschinen AG
33	U.S. Patent No. 4,399,767 entitled: Varnishing Unit in the Delivery Unit of a Sheet-Fed Rotary Printing Press, Issued on August 23, 1983 to Claus Simeth, Assignee: M.A.N. - Roland Druckmaschinen AG
34	U.S. Patent No. 4,421,027 entitled: Multiple Printing Mode Printing Machine System, Issued on December 20, 1983 to Hermann Fischer, Assignee: M.A.N. - Roland Druckmaschinen AG
35	U.S. Patent No. 4,423,677 entitled: Rotary Sheet Offset Printing Machine, Issued on January 3, 1984 to Hermann Fischer, Assignee: M.A.N. - Roland Druckmaschinen AG

Index No.	**Description**
36	U.S. Patent No. 4,446,814 entitled: Device for Applying a Fluid, in Particular Lacquers on Printed Sheets or Continuous Webs, Issued on May 8, 1984 to Paul Abendroth and Janko Despot, Assignee: M.A.N. - Roland
37	U.S. Patent No. 4,501,223 entitled: Coating Apparatus, Issued on February 26, 1985 to Sadayuki Matsuno, Hiroshi Itoh, Isamu Nishikawa, Tatsuo Awazu, Toshio Matsunaga, Yoshitaka Kitaoka, Goro Sugimoto and Hiroki Nishinaka, Assignee: Hitachi Zosen Corporation
38	U.S. Patent No. 4,524,712 entitled: Varnish Coater for Printed Product, Issued on June 25, 1985 to Kiyoshi Ito, Assignee: Komori Printing Machinery Co., Ltd.
39	U.S. Patent No. 4,536,218 entitled: Process and Compositions for Lithographic Printing in Mulitple Layers, Issued on August 20, 1985 to Eli A. Ganho
40	U.S. Patent No. 4,569,306 entitled: Varnish Coater for Printed Product, Issued on February 11, 1986 to Kiyoshi Ito, Assignee: Komori Printing Machinery Co, Ltd.
41	U.S. Patent No. 4,615,293 entitled: Medium-Applying Device in a Printing Machine, Issued on October 7, 1986 to Hans-Georg Jahn, Assignee: Heidelberger Druckmaschinen AG
42	U.S. Patent No. 4,685,414 entitled: Coating Printed Sheets, Issued on August 11, 1987 to Mark A. DiRico
43	U.S. Patent No. 4,706,601 entitled: Device for Applying Medium After Termination of the Printing Operation in a Printing Machine, Issued on November 17, 1987 to Hans-Georg Jahn, Assignee: Heidelberger Druckmaschinen AG
44	U.S. Patent No. 4,779,557 entitled: Coater for a Sheet Fed Printing Press, Issued October 25, 1988 to Joseph Frazzitta
45	U.S. Patent No. 4,796,528 entitled: Separated Ink Fountain for a Flexographic Printing Machine, Issued on January 10, 1989 to David J. Sarazen, Assignee: M.A.N. Roland Druckmaschinen AG
46	U.S. Patent No. 4,796,556 entitled: Adjustable Coating and Printing Apparatus, Issued on January 10, 1989 to John W. Bird, Assignee: Birow, Inc.

Index No.	Description
47	U.S. Patent No. 4,815,413 entitled: Varnishing Apparatus for Printed Sheet, Issued on March 28, 1989 to Toshio Kota, Assignee: Komori Printing Machinery Co., Ltd.
48	U.S. Patent No. 4,852,515 entitled: Device for Automatically Controlling Coating Amount for Use in Coating Machine, Issued on August 1, 1989 to Yoshiyasu Terasaka and Masao Tanabe, Assignee: Chugai Ro Co, Ltd.
49	U.S. Patent No. 4,934,305 entitled: Retractable Coater Assembly Including a Coating Blanket Cylinder, Issued on June 19, 1990 to Jamie E. Koehler and James E. Taylor, Assignee: Dahlgren International, Inc.
50	U.S. Patent No. 5,107,790 entitled: Two Headed Coater, Issued on April 28, 1992 to Larry J. Sliker and Robert S. Conklin, Assignee: Rapidac Machine Corp.
51	U.S. Patent No. 5,176,077 entitled: Coating Apparatus for Sheet-Fed, Offset Rotary Printing Presses, Issued on January 5, 1993 to Howard W. DeMoore, David D. Douglas and Steven M. Person, Assignee: Howard W. DeMoore
52	U.S. Patent No. 5,178,678 entitled: Retractable Coater Assembly Including a Coating Blanket Cylinder, Issued on January 12, 1993 to Jamie E. Koehler, James E. Taylor and Mark A. DiRico, Assignee: Dahlgren International, Inc.
53	U.S. Patent No. 5,189,960 entitled: Apparatus and Method for Controlling Temperature of Printing Plate on Cylinder in Rotary Press, Issued on March 2, 1993 to Fredric Valentini and David W. Moore
54	U.S. Patent No. 5,209,179 entitled: Liquid Coating Apparatus for use in Conjuction with Printing Presses where Access of the Coating Apparatus to the Press Cylinders is Restricted, Issued on May 11, 1993 to John C. Herbert and Frank A. Andaloro, Assignee: Herbert Products, Inc.
55	U.S. Patent No. 5,476,041 entitled: Printing Press Having a Device for Controlling the Air in a Sheet Feeder, Issued on December 19, 1995 to Ernst Czotscher, Assignee: Heidelberger Druckmaschinen AG

Index No.	**Description**
56	European Patent Application No. EP 0 767 054 A3 entitled: Printing or Coating Unit for a Rotary Offset Printing Press, Applicant: Howard W. DeMoore, Inventors: Howard W. DeMoore, Ronald M. Rendleman and John W. Bird, Filed on October 2, 1996, Date of Publication A3: April 29, 1998, Date of Publication A2: April 9, 1997
57	U.S. Patent No. 4,615,293 entitled: Medium-Applying Device in a Printing Machine, Issued on October 7, 1986 to Hans-Georg Jahn, Assignee: Heidelberger Druckmaschinen AG
58	U.S. Patent No. 5,107,790 entitled: Two Headed Coater, Issued on April 28, 1992 to Larry J. Sliker and Robert S. Conklin, Assignee:Rapidac Machine Corp.
59	Japanese Application No. 96281425

22

US005651316A

United States Patent [19]

DeMoore et al.

[11] Patent Number: 5,651,316

[45] Date of Patent: Jul. 29, 1997

[54] RETRACTABLE PRINTING/COATING UNIT OPERABLE ON THE PLATE AND BLANKET CYLINDERS SIMULTANEOUSLY FROM THE DAMPENER SIDE OF THE FIRST PRINTING UNIT OR ANY CONSECUTIVE PRINTING UNIT OF ANY ROTARY OFFSET PRINTING PRESS

[75] Inventors: Howard W. DeMoore, 10954 Shady Trail, Dallas, Tex. 75220; Ronald M. Rendleman, Dallas; John W. Bird, Carrollton, both of Tex.

[73] Assignee: Howard W. DeMoore, Dallas, Tex.

[21] Appl. No.: 538,123

[22] Filed: Oct. 2, 1995

[51] Int. Cl.^{6} B41M 4/00

[52] U.S. Cl. 101/450.1; 118/46; 101/424.1

[58] Field of Search 101/424.1, 450.1, 101/135, 141, 142, 211, 216, 232, 348–349; 118/46

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4,934,305	6/1990	Koehler et al.	118/46
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5,209,179	5/1993	Herbert et al.	118/46
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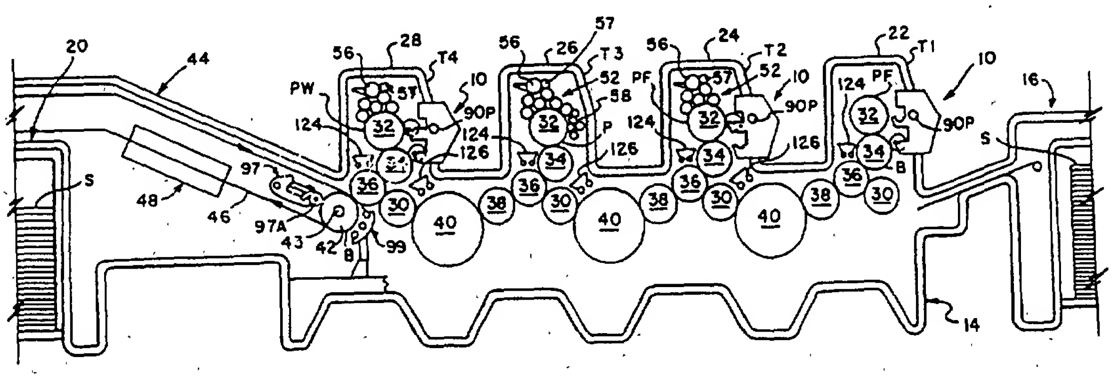
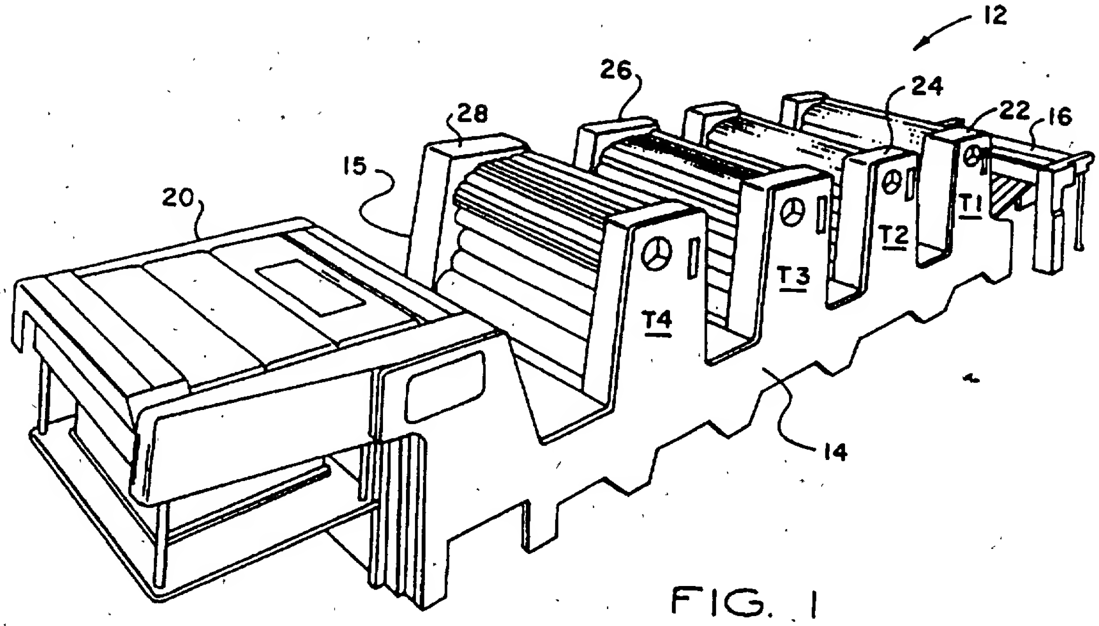
Primary Examiner—Eugene H. Eickholt
Attorney, Agent, or Firm—Sidley & Austin

[57] ABSTRACT

A retractable in-line inking/coating apparatus can apply either spot or overall inking/coating material to a plate and/or a blanket on the first printing unit or on any consecutive printing unit of any rotary offset printing press. The inking/coating apparatus is pivotally mounted within the conventional dampener space of any lithographic printing unit. The aqueous component of the flexographic printing ink or aqueous coating material is evaporated and dried by high velocity, hot air dryers and high performance heat and moisture extractors so that the aqueous or flexographic ink or coating material on a freshly printed or coated sheet is dry and can be dry-trapped on the next printing unit. The inking/coating apparatus includes dual cradles that support first and second applicator rollers so that the inking/coating apparatus can apply a double bump of aqueous/flexographic or UV-curable printing ink or coating material to a plate on the plate cylinder, while simultaneously applying aqueous, flexographic or UV-curable printing ink or coating material to a plate or a blanket on the blanket cylinder, and thereafter onto a sheet as the sheet is transferred through the nip between the blanket cylinder and the impression cylinder. A triple bump is printed or coated on the last printing unit with the aid of an impression cylinder inking/coating unit.

16 Claims, 10 Drawing Sheets

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T3
T4
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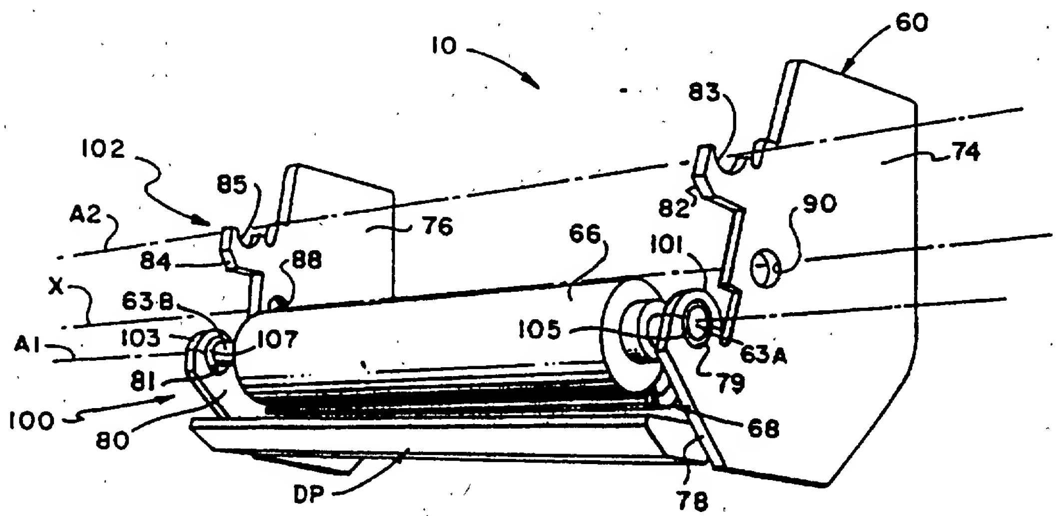
FIG. 1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100
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DP
78

FIG. 2

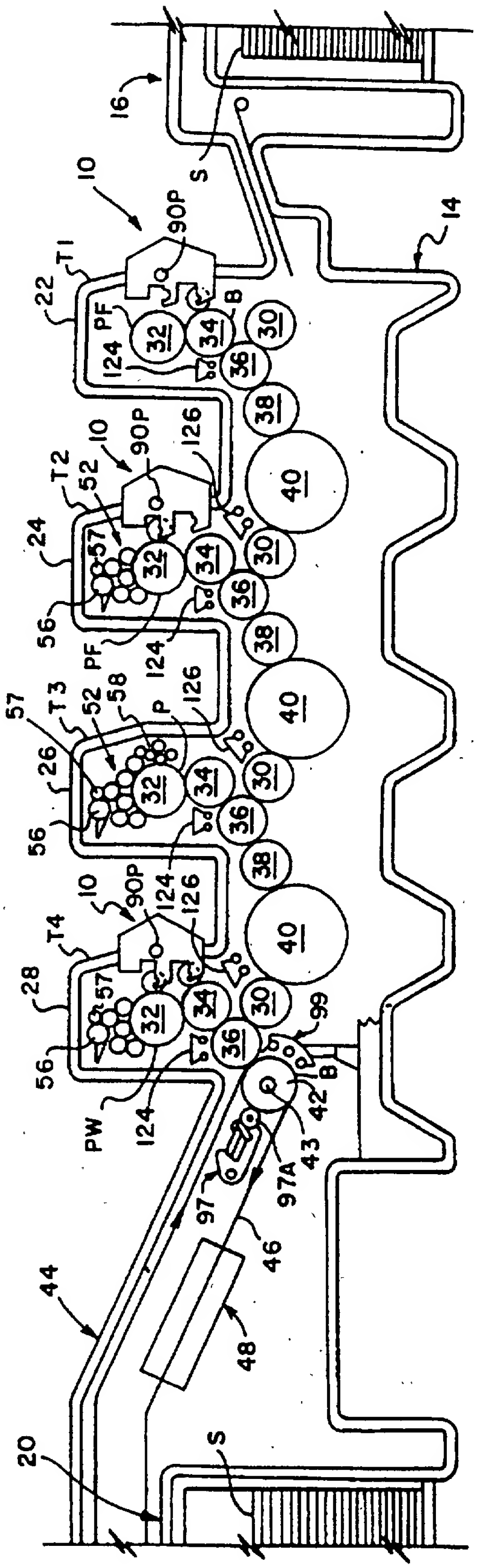
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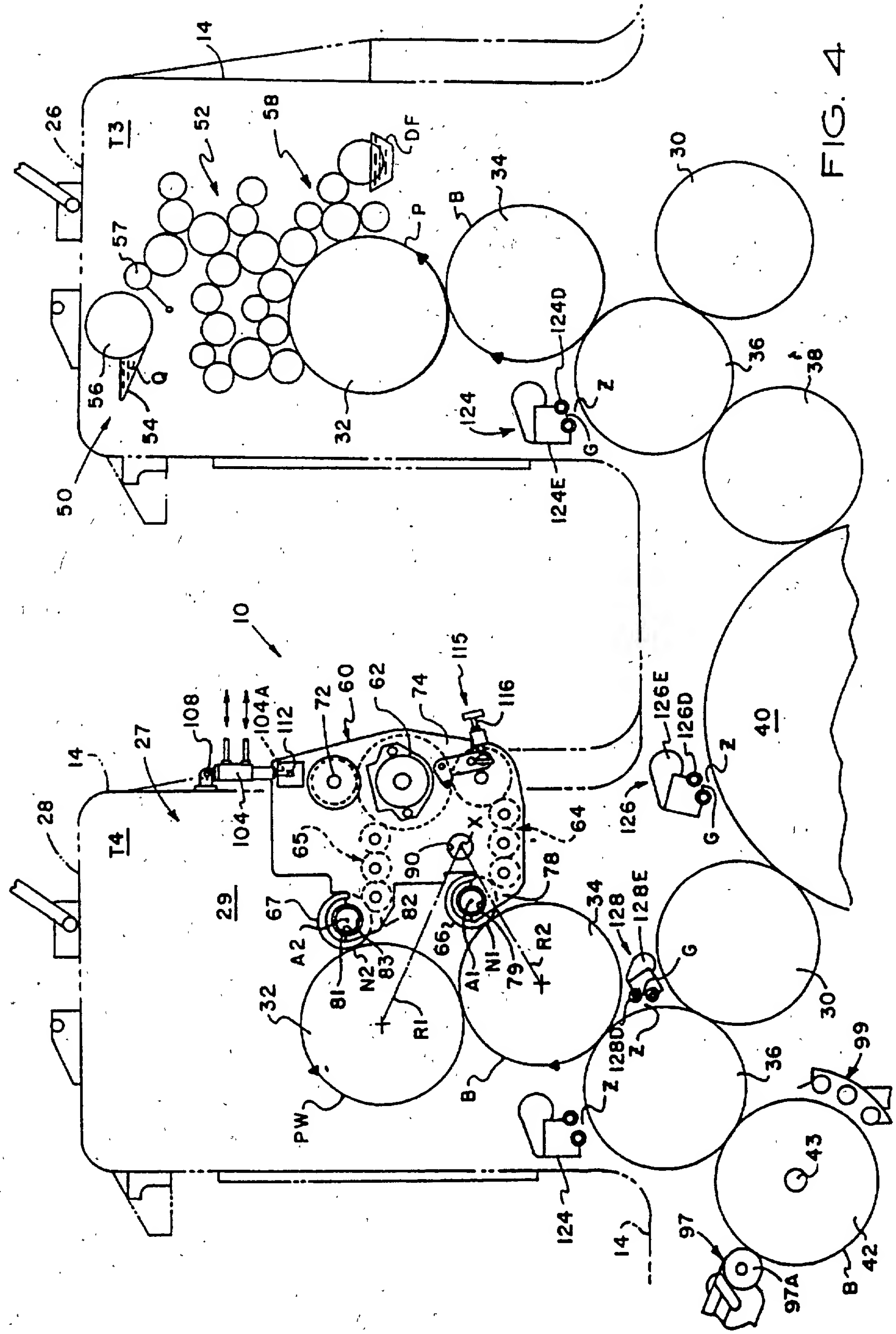
FIG. 3



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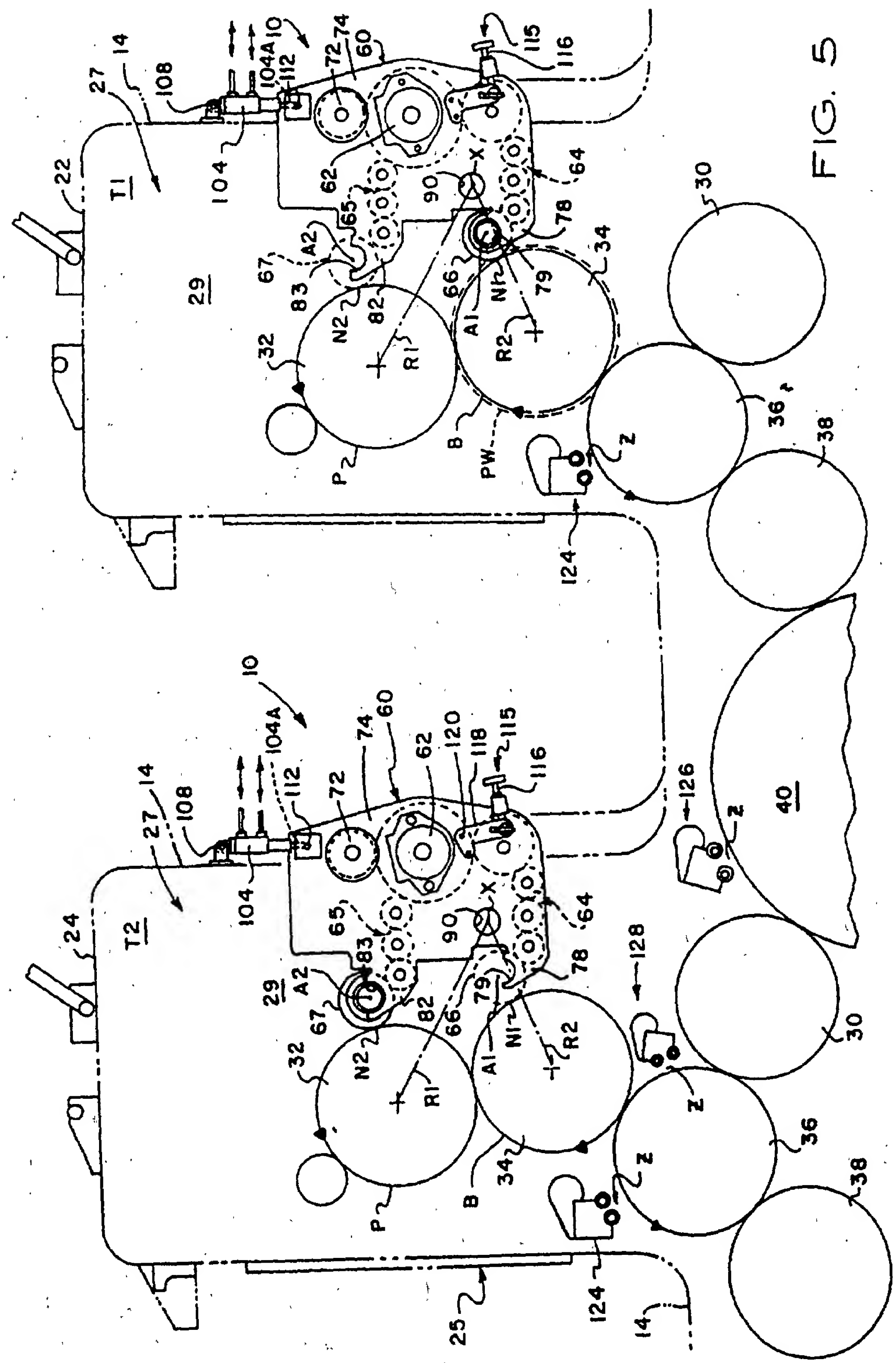

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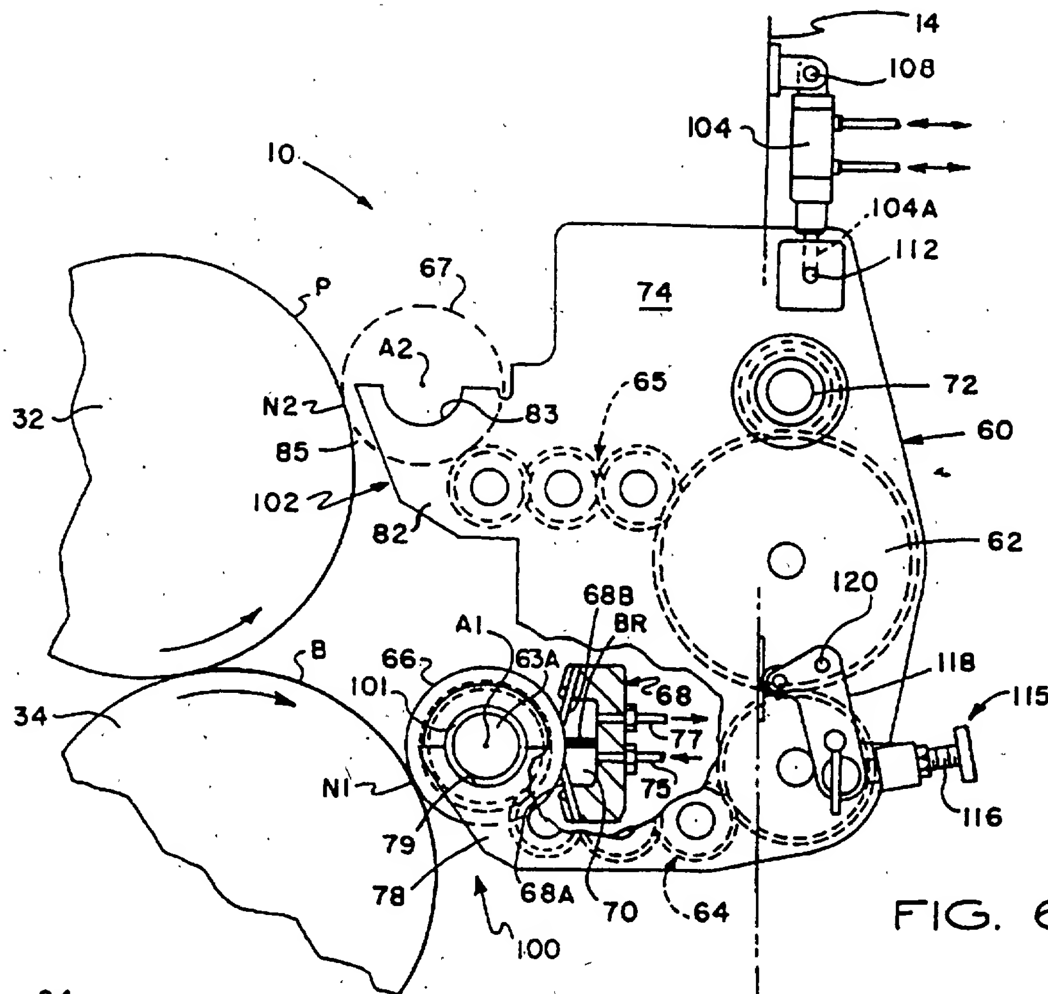
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68B
BR
120
A1
B
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115
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101
77
75
N1
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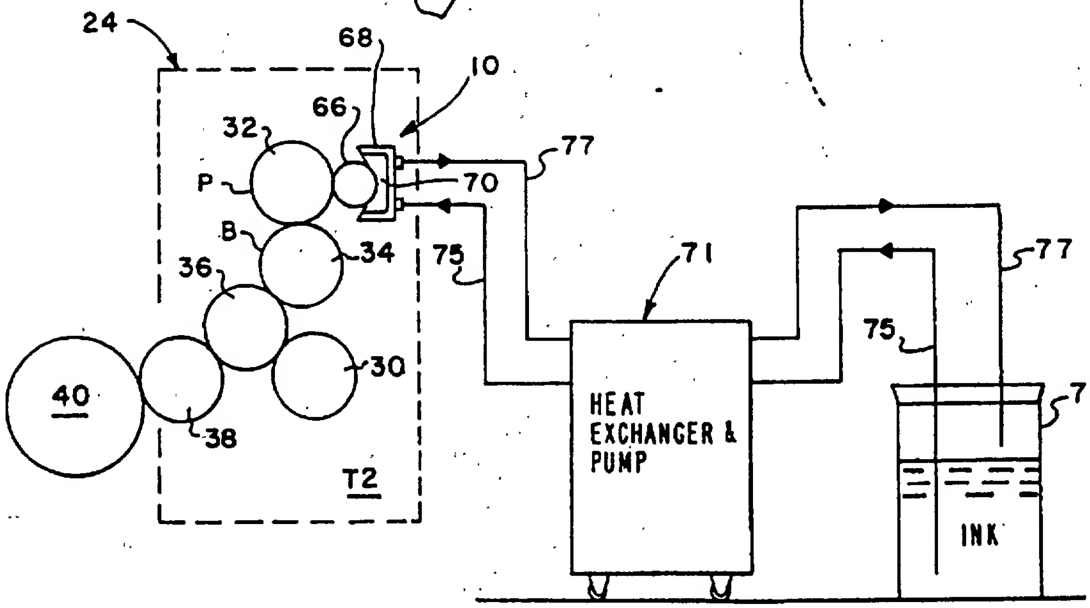
79
78
68A
70
64
100

FIG. 6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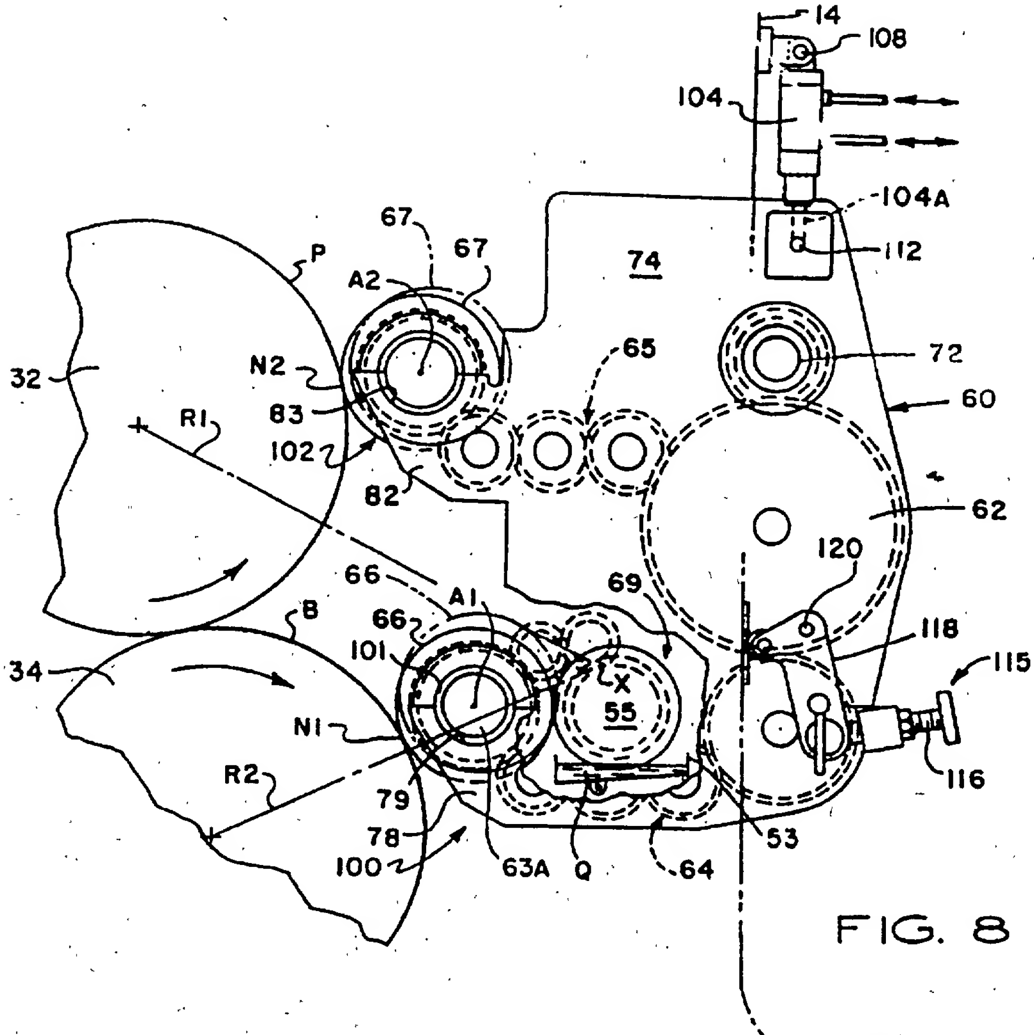
T2
HEAT
EXCHANGER &
PUMP
77
75
73
INK

FIG. 7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A1
69
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63A
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64

FIG. 8

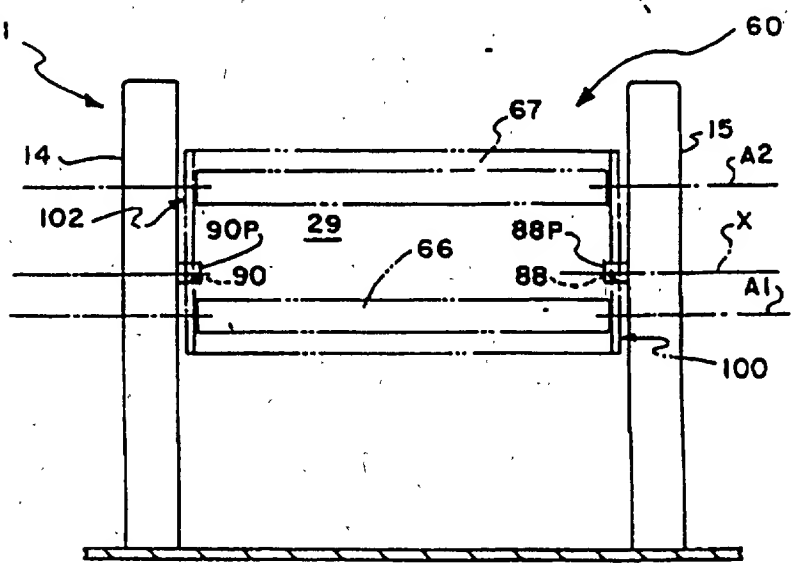
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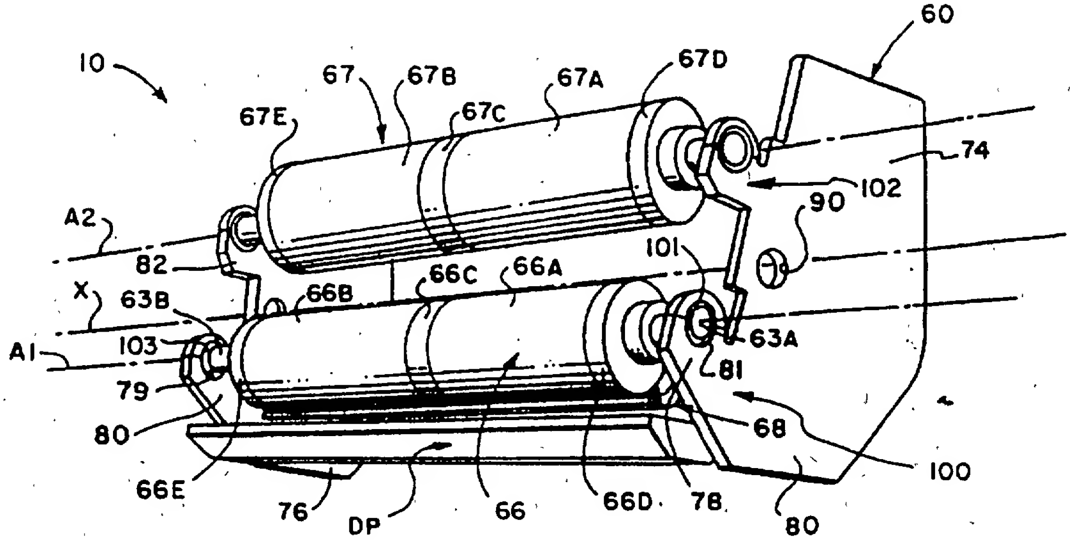
FIG. 9



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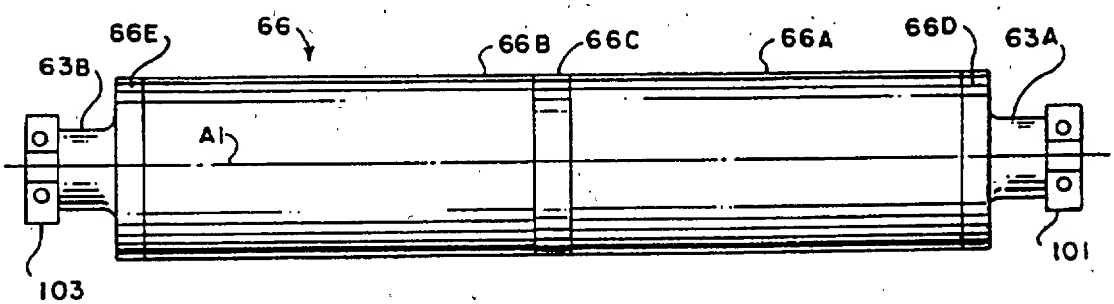

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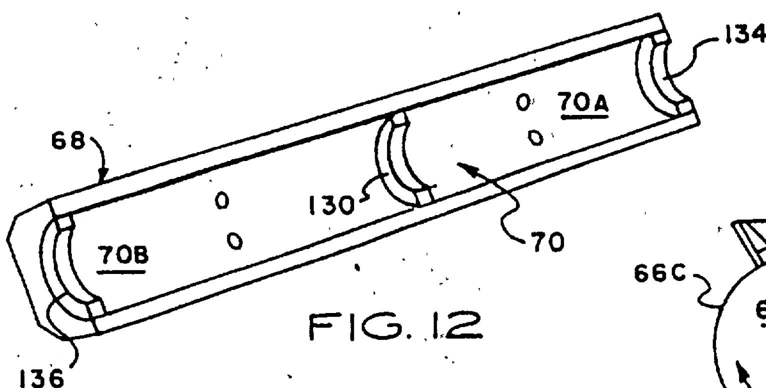

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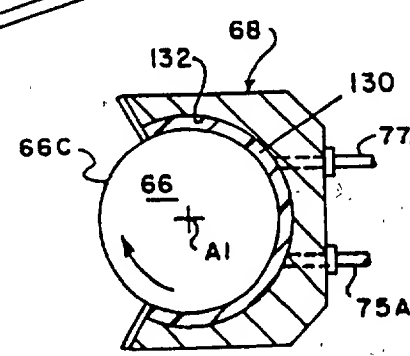

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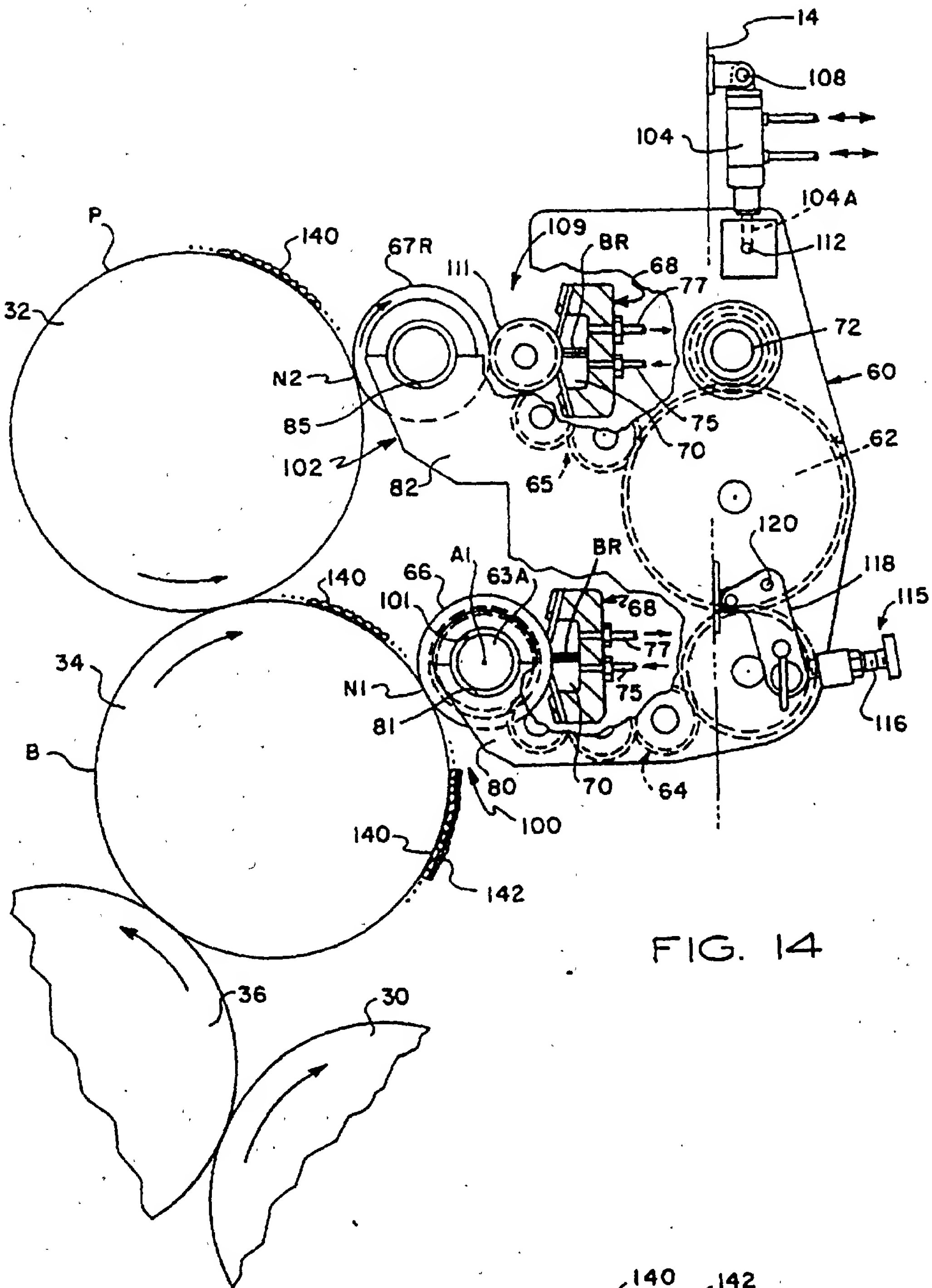
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BR
118
A1
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63A
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B
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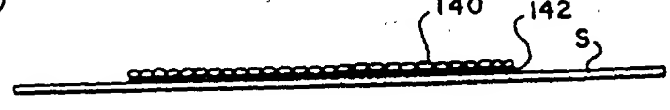
64
100
140
142
36
30

FIG. 14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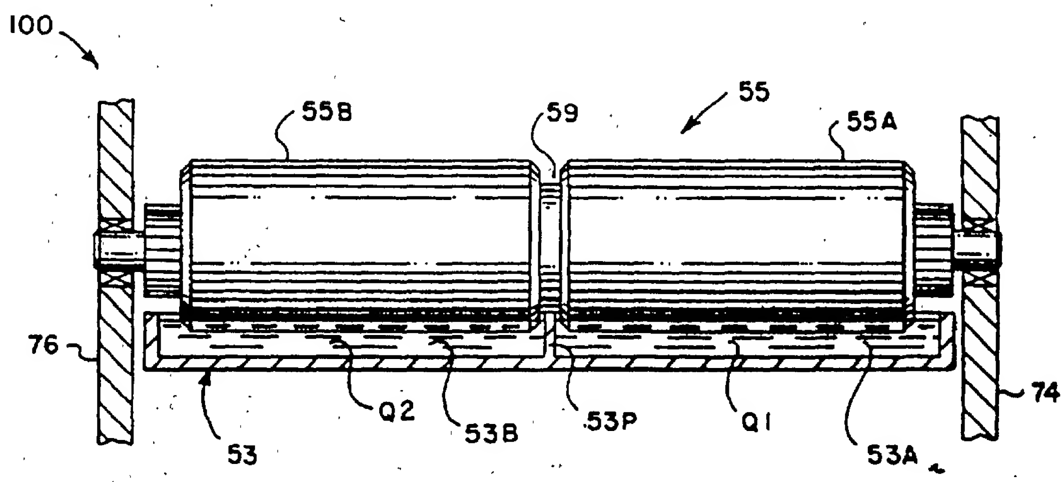
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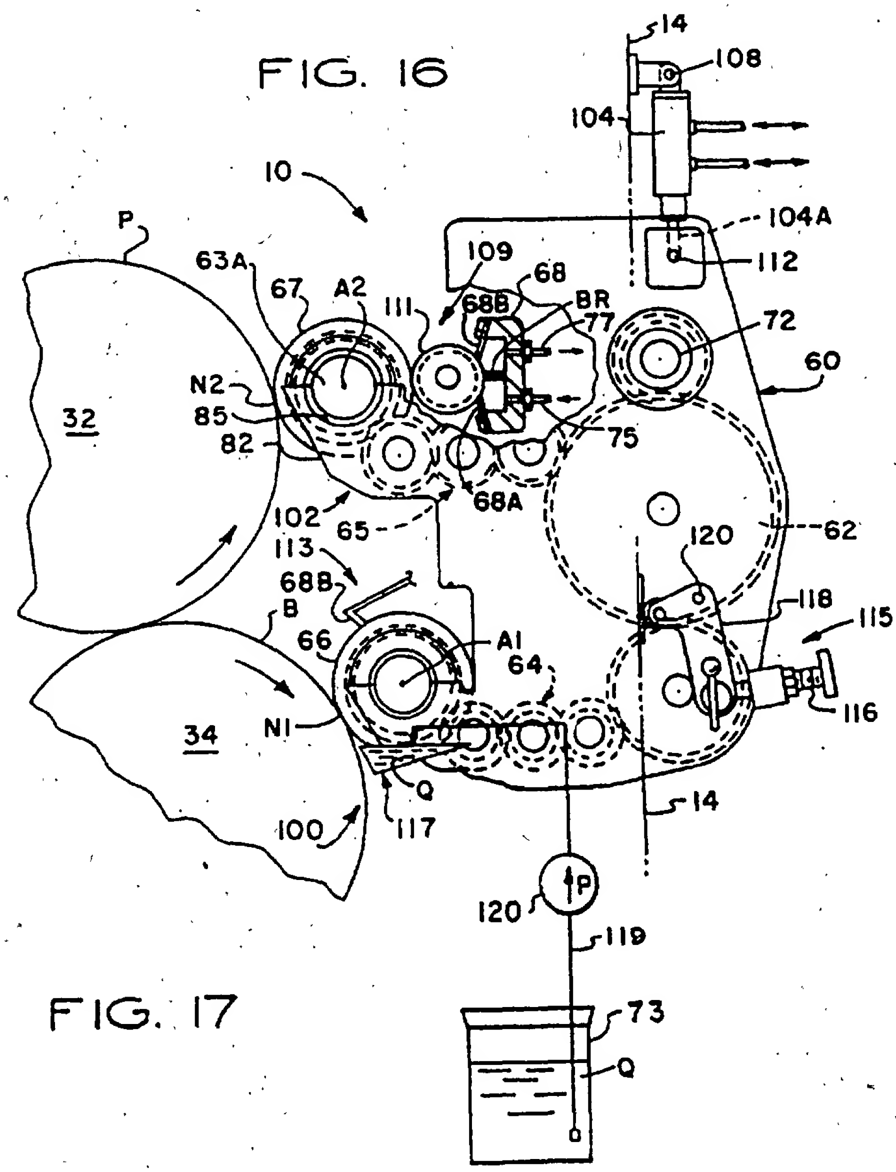
53P
Q1
53A
53

FIG. 16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68B
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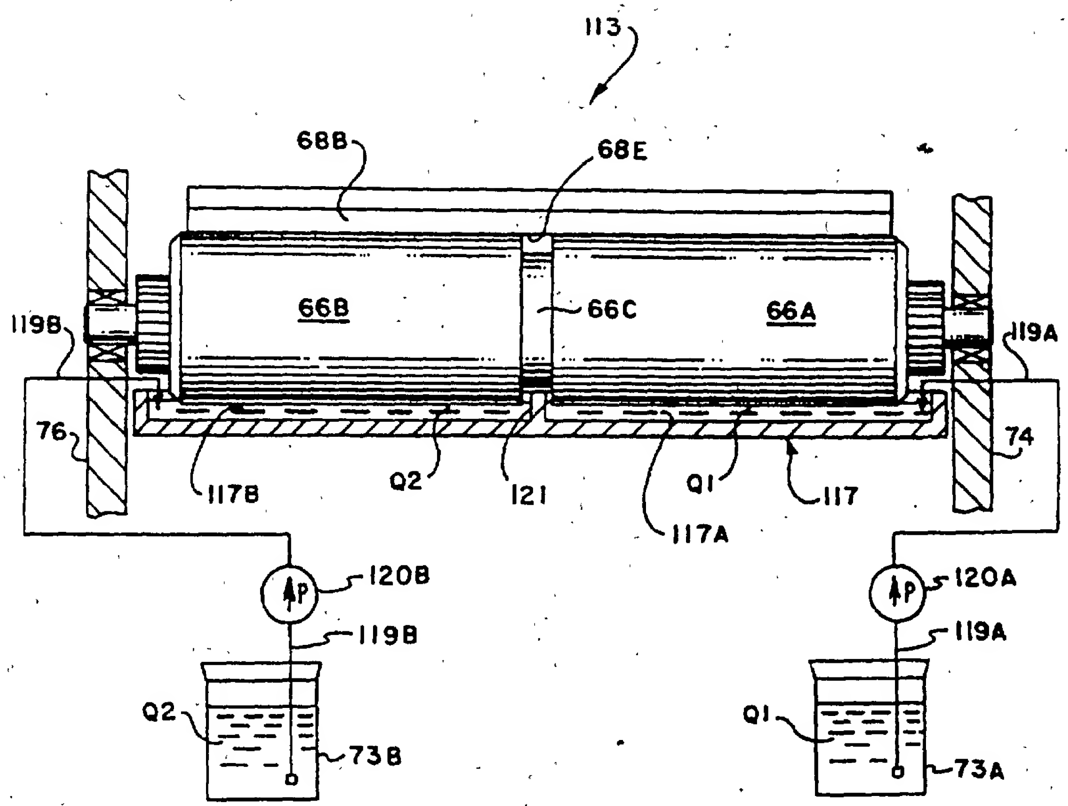
73
Q

FIG. 17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Q1
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120A
119B
119A
Q2
73B
Q1
73A

FIG. 18

RETRACTABLE PRINTING/COATING UNIT OPERABLE ON THE PLATE AND BLANKET CYLINDERS SIMULTANEOUSLY FROM THE DAMPENER SIDE OF THE FIRST PRINTING UNIT OR ANY CONSECUTIVE PRINTING UNIT OF ANY ROTARY OFFSET PRINTING PRESS

FIELD OF THE INVENTION

This invention relates generally to sheet-fed or web-fed, rotary offset lithographic printing presses, and more particularly, to a new and improved inking/coating apparatus for the in-line application of aqueous or flexographic printing inks, primer or protective/decorative coatings applied simultaneously to the plate and blanket of the first or any consecutive printing unit of any lithographic printing press.

BACKGROUND OF THE INVENTION

Conventional sheet-fed, rotary offset printing presses typically include one or more printing units through which individual sheets are fed and printed. After the last printing unit, freshly printed sheets are transferred by a delivery conveyor to the delivery end of the press where the freshly printed and/or coated sheets are collected and stacked uniformly. In a typical sheet-fed, rotary offset printing press such as the Heidelberg Speedmaster line of presses, the delivery conveyor includes a pair of endless chains carrying gripper bars with gripper fingers which grip and pull freshly printed sheets from the last impression cylinder and convey the sheets to the sheet delivery stacker.

Since the inks used with sheet fed rotary offset printing presses are typically wet and tacky, special precautions must be taken to prevent marking and smearing of the freshly printed or coated sheets as the sheets are transferred from one printing unit to another. The printed ink on the surface of the sheet dries relatively slowly and is easily smeared during subsequent transfer between printing units. Marking, smearing and smudging can be prevented by a vacuum assisted sheet transfer apparatus as described in the following U.S. Pat. Nos. 5,113,255; 5,127,329; 5,205,217; 5,228,391; 5,243,909; and 5,419,254, all to Howard W. DeMoore, co-inventor, and manufactured and sold by Printing Research, Inc. of Dallas, Tex., U.S.A. under its trademark BACVAC®.

In some printing jobs, offsetting is prevented by applying a protective and/or decorative coating material over all or a portion of the freshly printed sheets. Some coatings are formed of a UV-curable or water-dispersed resin applied as a liquid solution over the freshly printed sheets to protect the ink from offsetting or set-off and improve the appearance of the freshly printed sheets. Such coatings are particularly desirable when decorative or protective finishes are applied in the printing of posters, record jackets, brochures, magazines, folding cartons and the like.

DESCRIPTION OF THE PRIOR ART

Various arrangements have been made for applying the coating as an in-line printing operation by using the last printing unit of the press as the coating application unit. For example, U.S. Pat. Nos. 4,270,483; 4,685,414; and 4,779,557 disclose coating apparatus which can be moved into position to permit the blanket cylinder of the last printing unit of a printing press to be used to apply a coating material over the freshly printed sheets. In U.S. Pat. No. 4,841,903 (Bird) there are disclosed coating apparatus which can be

selectively moved between the plate cylinder or the blanket cylinder of the last printing unit of the press so the last printing unit can only be used for coating purposes. However, when coating apparatus of these types are being used, the last printing unit cannot be used to print ink to the sheets, but rather can only be used for the coating operation. Thus, while coating with this type of in-line coating apparatus, the printing press loses the capability of printing on the last printing unit as it is converted to a coating unit.

The coater of U.S. Pat. No. 5,107,790 (Sliker et al) is retractable along an inclined rail for extending and retracting a coater head into engagement with a blanket on the blanket cylinder. Because of its size, the rail-retractable coater can only be installed between the last printing unit of the press and the delivery sheet stacker, and cannot be used for interunit coating. The coater of U.S. Pat. No. 4,615,293 (Jahn) provides two separate, independent coaters located on the dampener side of a converted printing unit for applying lacquer to a plate and to a rubber blanket. Consequently, although a plate and blanket are provided, the coating unit of Jahn's press is restricted to a dedicated coating operation only.

Proposals have been made for overcoming the loss of a printing unit when in-line coating is used, for example as set forth in U.S. Pat. No. 5,176,077 to Howard W. DeMoore (co-inventor and assignee), which discloses a coating apparatus having an applicator roller positioned to apply the coating material to the freshly printed sheet while the sheet is still on the last impression cylinder of the press. This allows the last printing unit to print and coat simultaneously, so that no loss of printing unit capability results.

Some conventional coaters are rail-mounted and occupy a large amount of press space and reduce access to the press. Elaborate equipment is needed for retracting such coaters from the operative coating position to the inoperative position, which reduces access to the printing unit.

Accordingly, there is a need for an in-line inking/coating apparatus which does not result in the loss of a printing unit, does not extend the length of the press, and which can print and coat aqueous and flexographic inks and coating materials simultaneously onto the plate and blanket on any lithographic printing unit of any lithographic printing press, including the first printing unit.

OBJECTS OF THE INVENTION

Accordingly, a general object of the present invention is to provide improved inking/coating apparatus which is capable of selectively applying ink or coating material to a plate on a plate cylinder or ink or coating material to a plate or blanket on a blanket cylinder.

A specific object of the present invention is to provide improved inking/coating apparatus of the character described which is extendable into inking/coating engagement with either a plate on a plate cylinder or to a plate or blanket on a blanket cylinder.

A related object of the present invention is to provide improved inking/coating apparatus of the character described which is capable of being mounted on any lithographic printing unit of the press and does not interfere with operator access to the plate cylinder, blanket cylinder, or adjacent printing units.

Another object of the present invention is to provide improved inking/coating apparatus of the character described, which can be moved from an operative inking/coating engagement position adjacent to a plate cylinder or a blanket cylinder to a non-operative, retracted position.

Still another object of the present invention is to provide improved inking/coating apparatus of the character described, which can be used for applying aqueous, flexographic and ultra-violet curable inks and/or coatings in combination with lithographic, flexographic and waterless printing processes on any rotary offset printing press.

A related object of the present invention is to provide improved inking/coating apparatus of the character described, which is capable of applying aqueous or flexographic ink or coating material on one printing unit, for example the first printing unit, and drying the ink or coating material before it is printed or coated on the next printing unit so that it can be overprinted or overcoated immediately on the next printing unit with waterless, aqueous, flexographic or lithographic inks or coating materials.

Yet another object of the present invention is to provide improved inking/coating apparatus for use on a multiple color rotary offset printing press that can apply ink or coating material separately and/or simultaneously to the plate and/or blanket of a printing unit of the press from a single operative position, and from a single inking/coating apparatus.

A related object of the present invention is to provide improved inking/coating apparatus of the character described, in which virtually no printing unit adjustment or alteration is required when the inking/coating apparatus is converted from plate to blanket printing or coating and vice versa.

Another object of the present invention is to provide improved inking/coating apparatus that can be operably mounted in the dampener space of any lithographic printing unit for inking/coating engagement with either a plate on a plate cylinder or a plate or blanket on a blanket cylinder, and which does not interfere with operator movement or activities in the interunit space between printing units.

SUMMARY OF THE INVENTION

The foregoing objects are achieved by a retractable, in-line inking/coating apparatus which is mounted on the dampener side of any printing unit of a rotary offset press for movement between an operative (on-impression) inking/coating position and a retracted, disengaged (off-impression) position. The inking/coating apparatus includes an applicator roller which is movable into and out of engagement with a plate on a plate cylinder or a blanket on a blanket cylinder. The inking/coating applicator head is pivotally coupled to a printing unit by pivot pins which are mounted on the press side frames in the traditional dampener space of the printing unit in parallel alignment with the plate cylinder and the blanket cylinder. This dampener space mounting arrangement allows the inking/coating unit to be installed between any adjacent printing units on the press.

In the preferred embodiment, the applicator head includes vertically spaced pairs of cradle members with one cradle pair being adapted for supporting an inking/coating applicator roller in alignment with a plate cylinder, and the other cradle pair supporting an inking/coating applicator roller in alignment with the blanket cylinder, respectively, when the applicator head is in the operative position. Because of the pivotal support provided by the pivot pins, the applicator head can be extended and retracted within the limited space available in the traditional dampener space, without restricting operator access to the printing unit cylinders and without causing a printing unit to lose its printing capability.

When the inking/coating apparatus is used in combination with a flexographic printing plate and aqueous or flexographic ink or coating material, the water component of the aqueous or flexographic ink or coating material on the freshly printed or coated sheet is evaporated and dried by a high velocity, hot air interunit dryer and a high volume heat and moisture extractor assembly so that the freshly printed ink or coating material is dry before the sheet is printed or coated on the next printing unit. This quick drying process permits a base layer or film of ink, for example opaque white or metallic (gold, silver or other metallics) ink to be printed on the first printing unit, and then overprinted on the next printing unit without back-trapping or dot gain.

The construction and operation of the present invention will be understood from the following detailed description taken in conjunction with the accompanying drawings which disclose, by way of example, the principles and advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a sheet fed, rotary offset printing press having inking/coating apparatus embodying the present invention;

FIG. 2 is a simplified perspective view of the single head, dual cradle inking/coating apparatus of the present invention;

FIG. 3 is a schematic side elevational view of the printing press of FIG. 1 having single head, dual cradle inking/coating apparatus installed in the traditional dampener position of the first, second and last printing units;

FIG. 4 is a simplified side elevational view showing the single head, dual cradle inking/coating apparatus in the operative inking/coating position for simultaneously printing on the printing plate and blanket on the fourth printing unit;

FIG. 5 is a simplified side elevational view showing the single head, dual cradle inking/coating apparatus in the operative position for spot or overall inking or coating on the blanket of the first printing unit, and showing the dual cradle inking/coating apparatus in the operative position for spot or overall inking or coating on the printing plate of the second printing unit;

FIG. 6 is a simplified side elevational view of the single head, dual cradle inking/coating apparatus of FIG. 4 and FIG. 5, partially broken away, showing the single head, dual cradle inking/coating apparatus in the operative coating position and having a sealed doctor blade reservoir assembly for spot or overall coating on the blanket;

FIG. 7 is a schematic view showing a heat exchanger and pump assembly connected to the single head, dual cradle inking/coating apparatus for circulating temperature controlled ink or coating material to the inking/coating apparatus;

FIG. 8 is a side elevational view, partially broken away, and similar to FIG. 6 which illustrates an alternative coating head arrangement;

FIG. 9 is a simplified elevational view of a printing unit which illustrates pivotal coupling of the inking/coating apparatus on the printing unit side frame members;

FIG. 10 is a view similar to FIG. 2 in which a pair of split applicator rollers are mounted in the upper cradle and lower cradle, respectively;

FIG. 11 is a side elevational view of a split applicator roller;

FIG. 12 is a perspective view of a doctor blade reservoir which is centrally partitioned by a seal element;

FIG. 13 is a sectional view showing sealing engagement of the split applicator roller against the partition seal element of FIG. 12;

FIG. 14 is a view similar to FIG. 8 which illustrates an alternative inking/coating embodiment;

FIG. 15 is a simplified side elevational view of a substrate which has a bronzed-like finish which is applied by simultaneous operation of the dual applicator roller embodiment of FIG. 14;

FIG. 16 is a side elevational view, partly in section, of a pan roller having separate transfer surfaces mounted on a split fountain pan;

FIG. 17 is a simplified side elevational view of the dual cradle inking/coating apparatus, partially broken away, which illustrates an alternative inking/coating head apparatus featuring a single doctor blade assembly, anilox applicator roller mounted on the lower cradle; and

FIG. 18 is a side elevational view, partly in section, of a single doctor blade anilox applicator roller assembly having separate transfer surfaces, and a split fountain pan having separate fountain compartments, with the separate fountain compartments being supplied with different inks or coating materials from separate off-press sources.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As used herein, the term "processed" refers to printing and coating methods which can be applied to either side of a substrate, including the application of lithographic, waterless, UV-curable, aqueous and flexographic inks and/or coatings. The term "substrate" refers to sheet and web material. Also, as used herein, the term "waterless printing plate" refers to a printing plate having image areas and non-image areas which are oleophilic and oleophobic, respectively. "Waterless printing ink" refers to an oil-based ink which does not contain a significant aqueous component. "Flexographic plate" refers to a flexible printing plate having a relief surface which is wettable by flexographic ink or coating material. "Flexographic printing ink or coating material" refers to an ink or coating material having a base constituent of either water, solvent or UV-curable liquid. "UV-curable lithographic printing ink and coating material" refers to oil-based printing inks and coating materials that can be cured (dried) photomechanically by exposure to ultraviolet radiation, and that have a semi-paste or gel-like consistency. "Aqueous printing ink or coating material" refers to an ink or coating material that predominantly contains water as a solvent, diluent or vehicle. A "relief plate" refers to a printing plate having image areas which are raised relative to non-image areas which are recessed.

As shown in the exemplary drawings, the present invention is embodied in a new and improved in-line inking/coating apparatus, herein generally designated **10**, for applying aqueous, flexographic or UV-curable inks or protective and/or decorative coatings to sheets or webs printed in a sheet-fed or web-fed, rotary offset printing press, herein generally designated **12**. In this instance, as shown in FIG. 1, the inking/coating apparatus **10** is installed in a four unit rotary offset printing press **12**, such as that manufactured by Heidelberger Druckmaschinen AG of Germany under its designation Heidelberg Speedmaster SM102 (40", 102 cm).

The press **12** includes a press frame **14** coupled at one end, herein the right end, to a sheet feeder **16** from which sheets, herein designated S, are individually and sequentially fed into the press, and at the opposite end, with a sheet delivery stacker **20** in which the freshly printed sheets are collected and stacked. Interposed between the sheet feeder **16** and the sheet delivery stacker **20** are four substantially identical sheet printing units **22**, **24**, **26** and **28** which can print four

different colors onto the sheets as they are transferred through the press **12**. The printing units are housed within printing towers T1, T2, T3 and T4 formed by side frame members **14**, **15**. Each printing tower has a delivery side **25** and a dampener side **27**. A dampener space **29** is partially enclosed by the side frames on the dampener side of the printing unit.

As illustrated, the printing units **22**, **24**, **26** and **28** are substantially identical and of conventional design. The first printing unit **22** includes an in-feed transfer cylinder **30**, a plate cylinder **32**, a blanket cylinder **34** and an impression cylinder **36**, all supported for rotation in parallel alignment between the press side frames **14**, **15** which define printing unit towers T1, T2, T3 and T4. Each of the first three printing units **22**, **24** and **26** have a transfer cylinder **38** disposed to transfer the freshly printed sheets from the adjacent impression cylinder and transfer the freshly printed sheets to the next printing unit via an intermediate transfer drum **40**.

The last printing unit **28** includes a delivery cylinder **42** mounted on a delivery shaft **43**. The delivery cylinder **42** supports the freshly printed sheet **18** as it is transferred from the last impression cylinder **36** to a delivery conveyor system, generally designated **44**, which transfers the freshly printed sheet to the sheet delivery stacker **20**. To prevent smearing during transfer, a flexible covering is mounted on the delivery cylinder **42**, as described and claimed in U.S. Pat. No. 4,402,267 to Howard W. DeMoore, which is incorporated herein by reference. The flexible covering is manufactured and sold by Printing Research, Inc. of Dallas, Tex., U.S.A., under its trademark SUPER BLUE®. Optionally, a vacuum-assisted sheet transfer assembly manufactured and sold by Printing Research, Inc. of Dallas, Tex., U.S.A., under its trademark BACVAC® can be substituted for the delivery transfer cylinder **42** and flexible covering.

The delivery conveyor system **44** as shown in FIG. 3 is of conventional design and includes a pair of endless delivery gripper chains **46**, only one of which is shown carrying at regular spaced locations along the Chains, laterally disposed gripper bars having gripper fingers used to grip the leading edge of a freshly printed or coated sheet **18** after it leaves the nip between the impression cylinder **36** and delivery cylinder **42** of the last printing unit **28**. As the leading edge is gripped by the gripper fingers, the delivery chains **46** pull the sheet away from the last impression cylinder **36** and convey the freshly printed or coated sheet to the sheet delivery stacker **20**.

Prior to reaching the delivery sheet stacker, the freshly printed and/or coated sheets S pass under a delivery dryer **48** which includes a combination of infra-red thermal radiation, high velocity hot air flow and a high performance heat and moisture extractor for drying the ink and/or the protective/decorative coating. Preferably, the delivery dryer **48**, including the high performance heat and moisture extractor is constructed as described in U.S. application Ser. No. 08/116,711, filed Sep. 3, 1993, entitled "Infra-Red Forced Air Dryer and Extractor" by Howard C. Secor, Ronald M. Rendleman and Paul D. Copenhaver, commonly assigned to the assignee of the present invention, Howard W. DeMoore, and licensed to Printing Research, Inc. of Dallas, Tex., U.S.A., which manufactures and markets the delivery dryer **48** under its trademark AIR BLANKET™.

In the exemplary embodiment shown in FIG. 3, the first printing unit **22** has a flexographic printing plate PF mounted on the plate cylinder, and therefore neither an inking roller train nor a dampening system is required. A

flexographic printing plate PF is also mounted on the plate cylinder of the second printing unit 24. The form rollers of the inking roller train 52 shown mounted on the second printing unit 24 are retracted and locked off to prevent plate contact. Flexographic ink is supplied to the flexographic plate PF of the second printing unit 24 by the inking/coating apparatus 10.

A suitable flexographic printing plate PF is offered by E.I. du Pont de Nemours of Wilmington, Del., U.S.A., under its trademark CYREL®. Another source is BASF Aktiengesellschaft of Ludwigshafen, Germany, which offers a suitable flexographic printing plate under its trademark NYLOFLEX®.

The third printing unit 26 as illustrated in FIG. 3 and FIG. 4 is equipped for lithographic printing and includes an inking apparatus 50 having an inking roller train 52 arranged to transfer ink Q from an ink fountain 54 to a lithographic plate P mounted on the plate cylinder 32. This is accomplished by a fountain roller 56 and a ductor roller 57. The fountain roller 56 projects into the ink fountain 54, whereupon its surface picks up ink. The lithographic printing ink Q is transferred from the fountain roller 56 to the inking roller train 52 by the ductor roller 57. The inking roller train 52 supplies ink Q to the image areas of the lithographic printing plate P.

The lithographic printing ink Q is transferred from the lithographic printing plate P to an ink receptive blanket B which is mounted on the blanket cylinder 34. The inked image carried on the blanket B is transferred to a substrate S as the substrate is transferred through the nip between the blanket cylinder 34 and the impression cylinder 36.

The inking roller arrangement 52 illustrated in FIG. and FIG. 4 is exemplary for use in combination with lithographic ink printing plates P. It is understood that a dampening system 58 having a dampening fluid reservoir DF is coupled to the inking roller train 52 (FIG. 4), but is not required for water-less or flexographic printing.

The plate cylinder 32 of printing unit 28 is equipped with a waterless printing plate PW. Waterless printing plates are also referred to as dry planographic printing plates and are disclosed in the following U.S. Pat. Nos.: 3,910,187; Re. 30,670.; 4,086,093; and 4,853,313. Suitable waterless printing plates can be obtained from Toray Industries, Inc. of Tokyo, Japan. A dampening system is not used for waterless printing, and waterless (oil-based) printing ink is used. The waterless printing plate PW has image areas and non-image areas which are oleophilic/hydrophilic and oleophobic/hydrophobic, respectively. The waterless printing plate PW is engraved or etched, with the image areas being recessed with respect to the non-image areas. The image area of the waterless printing plate PW is rolled-up with the flexographic or aqueous printing ink which is transferred by the applicator roller 66. Both aqueous and oil-based inks and coatings are repelled from the non-image areas, and are retained in the image areas. The printing ink or coating is then transferred from the image areas to an ink or coating receptive blanket B and is printed or coated onto a substrate S.

For some printing jobs, a flexographic plate PF or a waterless printing plate PW is mounted over a resilient packing such as the blanket B on the blanket cylinder 34, for example as indicated by phantom lines in printing unit 22 of FIG. 5. An advantage of this alternative embodiment is that the waterless plate PW or the flexographic plate PF are resiliently supported over the blanket cylinder by the underlying blanket B or other resilient packing. The radial deflection and give of the resilient blanket B provides uniform, positive engagement between the applicator roller 66 and a flexographic plate or waterless plate.

In that arrangement, a plate is not mounted on the plate cylinder 32; instead, a waterless plate PW is mounted on the blanket cylinder, and the inked image on the waterless printing plate is not offset but is instead transferred directly from the waterless printing plate PW to the substrate S. The water component of flexographic ink on the freshly printed sheet is evaporated by high velocity, hot air dryers and high volume heat and moisture extractors so that the freshly printed aqueous or flexographic ink is dried before the substrate is printed on the next printing unit.

Referring now to FIG. 2, FIG. 3 and FIG. 9, the inking/coating apparatus 10 is pivotally mounted on the side frames 14, 15 for rotation about an axis X. The inking/coating apparatus 10 includes a frame 60, a hydraulic motor 62, a lower gear train 64, an upper gear train 65, an applicator roller 66, a sealed doctor blade assembly 68 (FIG. 6), and a drip pan DP, all mounted on the frame 60. The external peripheral surface of the applicator roller 66 is wetted by contact with liquid coating material or ink contained in a reservoir 70.

The hydraulic motor 62 drives the applicator roller 66 synchronously with the plate cylinder 32 and the blanket cylinder 34 in response to an RPM control signal from the press drive (not illustrated) and a feedback signal developed by a tachometer 72. While a hydraulic drive motor is preferred, other drive means such as an electric drive motor or an equivalent can be used.

When using waterless printing plate systems, the temperature of the waterless printing ink and of the waterless printing plate must be closely controlled for good image reproduction. For example, for waterless offset printing with TORAY waterless printing plates PW, it is absolutely necessary to control the waterless printing plate surface and waterless ink temperature to a very narrow range, for example 24° C. (75° F.) to 27° C. (80° F.).

Referring to FIG. 7, the reservoir 70 is supplied with ink or coating which is temperature controlled by a heat exchanger 71. The temperature controlled ink or coating material is circulated by a positive displacement pump, for example a peristaltic pump, through the reservoir 70 and heat exchanger 71 from a source 73 through a supply conduit 75 and a return conduit 77. The heat exchanger 71 cools or heats the ink or coating material and maintains the ink or coating and the printing plate within the desired narrow temperature range.

According to one aspect of the present invention, aqueous/flexographic ink or coating material is supplied to the applicator roller 66, which transfers the aqueous/flexographic ink or coating material to the printing plate (FIG. 7), which may be a waterless printing plate or a flexographic printing plate. When the inking/coating apparatus is used for applying aqueous/flexographic ink or coating material to a waterless printing plate PW, the inking roller train 52 is not required, and is retracted away from the printing plate. Because the viscosity of aqueous/flexographic printing ink or coating material varies with temperature, it is necessary to heat or cool the aqueous/flexographic printing ink or coating material to compensate for ambient temperature variations to maintain the ink viscosity in a preferred operating range.

For example, the temperature of the printing press can vary from around 60° F. 15° C.) in the morning, to around 85° F. (29° C.) or more in the afternoon. The viscosity of

aqueous/flexographic printing ink or coating material can be marginally high when the ambient temperature of the press is near 60° F. 15° C.), and the viscosity can be marginally low when the ambient temperature of the press exceeds 85° F. (29° C.). Consequently, it is desirable to control the temperature of the aqueous/flexographic printing ink or coating material so that it will maintain the surface temperature of waterless printing plates within the specified temperature range. Moreover, the ink/coating material temperature should be controlled to maintain the tack of the aqueous/flexographic printing ink or coating material within a desired range when the ink or coating material is being used in connection with flexographic printing processes.

The applicator roller 66 is preferably an anilox fluid metering roller which transfers measured amounts of printing ink or coating material to a plate or blanket. The surface of an anilox roller is engraved with an array of closely spaced, shallow depressions referred as "cells". Ink or coating from the reservoir 70 flows into the cells as the anilox roller turns through the reservoir. The transfer surface of the anilox roller is "doctored" (wiped or scraped) by dual doctor blades 68A, 68B to remove excess ink or coating material. The ink or coating metered by the anilox roller is that contained within the cells. The dual doctor blades 68A, 68B also seal the supply reservoir 70.

The anilox applicator roller 66 is cylindrical and may be constructed in various diameters and lengths, containing cells of various sizes and shapes. The volumetric capacity of an anilox roller is determined by cell size, shape and number of cells per unit area. Depending upon the intended application, the cell pattern may be fine (many small cells per unit area) or coarse (fewer large cells per unit area).

By supplying the ink or coating material through the inking/coating apparatus 10, more ink or coating material can be applied to the sheet S as compared with the inking roller train of a lithographic printing unit. Moreover, color intensity is stronger and more brilliant because the aqueous or flexographic ink or coating material is applied at a much heavier film thickness or weight than can be applied by the lithographic process, and the aqueous or flexographic colors are not diluted by dampening solution.

Preferably, the sealed doctor blade assembly 68 is constructed as described in U.S. Pat. No. 5,176,077 to Howard W. DeMoore, co-inventor and assignee, which is incorporated herein by reference. An advantage of using a sealed reservoir is that fast drying ink or coating material can be used. Fast drying ink or coating material can be used in an open fountain 53 (see FIG. 8); however, open air exposure causes the water and solvents in the fast-drying ink or coating material to evaporate faster, thus causing the ink or coating material to dry prematurely and change viscosity. Moreover, an open fountain emits unwanted odors into the press room. When the sealed doctor blade assembly is utilized, the pump (FIG. 7) which circulates ink or coating material to the doctor blade head is preferably a peristaltic pump, which does not inject air into the feeder lines which supply the ink or coating reservoir 70 and helps to prevent the formation of air bubbles and foam within the ink or coating material.

An inking/coating apparatus 10 having an alternative applicator roller arrangement is illustrated in FIGS. 10–13. In this arrangement, the engraved metering surface of the anilox applicator rollers 66, 67 are partitioned by smooth seal surfaces 66C which separates a first engraved peripheral surface portion 66A from a second engraved peripheral surface portion 66B. Likewise, smooth seal surfaces 66D, 66E are formed on the opposite end portions of the applicator roller 66 for engaging end seals 134, 136 (FIG. 12) of the doctor blade reservoir. The upper applicator roller 67 has engraved anilox metering surfaces 67A and 67B which are separated by a smooth seal band 67C.

Referring now to FIG. 12 and FIG. 13, the reservoir 70 of the doctor blade head 68 is partitioned by a curved seal element 130 to form two separate chambers 70A, 70B. The seal element 130 is secured to the doctor blade head within an annular groove 132. The seal element 130 is preferably made of polyurethane foam or other durable, resilient foam material. The seal element 130 is engaged by the seal band 66C, thus forming a rotary seal which blocks the leakage of ink or coating material from one reservoir chamber into the other reservoir chamber. Moreover, the seal band provides an unprinted or uncoated area which separates the printed or coated areas from each other, which is needed for work and turn printing jobs or other printing jobs which print two or more separate images onto the same substrate.

Another advantage of the split applicator roller embodiment is that it enables two or more flexographic inks or coating materials to be printed simultaneously within the same lithographic printing unit. That is, the reservoir chambers 70A, 70B of the upper doctor blade assembly can be supplied with gold ink and silver ink, for example, while the reservoir chambers 70A, 70B of the lower doctor blade assembly can be supplied with inks of two additional colors, for example opaque white ink and blue ink. This permits the opaque white ink to be overprinted with the gold ink, and the blue ink to be overprinted with the silver ink on the same printing unit on any lithographic press.

Moreover, a catalyst can be used in the upper doctor blade reservoir and a reactive ink or coating material can be used in the lower doctor blade reservoir. This can provide various effects, for example improved chemical resistance and higher gloss levels.

The split applicator roller sections 67A, 67B in the upper cradle position can be used for applying two separate inks or coating materials simultaneously, for example flexographic, aqueous and ultra-violet curable inks or coating materials, to separate surface areas of the plate, while the lower applicator roller sections 66A, 66B can apply an initiator layer and a micro-encapsulated layer simultaneously to separate blanket surface areas. Optionally, the metering surface portions 66A, 66B can be provided with different cell metering capacities for providing different printing effects which are being printed simultaneously. For example, the screen line count on one half-section of an anilox applicator roller is preferably in the range of 200–600 lines per inch (79–236 lines per cm) for half-tone images, and the screen line count of the other half-section is preferably in the range of 100–300 lines per inch (39–118 lines per cm) for overall coverage, high weight applications such as opaque white. This split arrangement in combination with dual applicator rollers is particularly advantageous when used in connection with "work and turn" printing jobs.

Referring again to FIG. 8, instead of using the sealed doctor blade reservoir assembly 68 as shown in FIG. 6, an open fountain assembly 69 is provided by the fountain pan 53 which contains a volume of liquid ink Q or coating material. The liquid ink or coating material is transferred to the applicator roller 66 by a pan roller 55 which turns in contact with ink Q or coating material in the fountain pan. If a split applicator roller is used, the pan roller 55 is also split, and the pan is divided into two pan sections 53A, 53B by a separator plate 53P, as shown in FIG. 16.

In the alternative embodiment of FIG. 16, the pan roller **55** is divided into two pan roller sections **55A**, **55B** by a centrally located, annular groove **59**. The separator plate **53P** is received within and centrally aligned with the groove **59**, but does not touch the adjoining roller faces. By this arrangement, two or more inks or coating materials **Q1**, **Q2** are contained within the open pan sections **55A**, **55B** for transfer by the split pan roller sections **53A**, **53B**, respectively. This permits two or more flexographic inks or coating materials to be transferred to two separate image areas on the plate or on the blanket of the same printing unit. This arrangement is particularly advantageous for work and turn printing jobs or other printing jobs which print two or more separate images onto the same substrate.

The frame **60** of the inking/coating apparatus **10** includes side support members **74**, **76** which support the applicator roller **66**, gear train **64**, gear train **65**, doctor blade assembly **68** and the drive motor **62**. The applicator roller **66** is mounted on stub shafts **63A**, **63B** which are supported at opposite ends on a lower cradle assembly **100** formed by a pair of side support members **78**, **80** which have sockets **79**, **81** and retainer caps **101**, **103**. The stub shafts are received in roller bearings **105**, **107** which permit free rotation of the applicator roller **66** about its longitudinal axis A1 (axis A2 in the upper cradle). The retainer caps **101**, **103** hold the stub shafts **63A**, **63B** and bearings **105**, **107** in the sockets **79**, **81** and hold the applicator roller **66** in parallel alignment with the pivot axis X.

The side support members **74**, **76** also have an upper cradle assembly **102** formed by a pair of side support members **82**, **84** which are vertically spaced with respect to the lower side plates **78**, **80**. Each cradle **100**, **102** has a pair of sockets **79**, **81** and **83**, **85**, respectively, for holding an applicator roller **66**, **67** for spot coating or inking engagement with the printing plate P the plate cylinder **32** (FIG. **4**) or with a printing plate P or a blanket B on the blanket cylinder **34**.

Preferably, the applicator roller **67** (FIG. **8**, FIG. **9**) the upper cradle (plate) position is an anilox roller having a resilient transfer surface. In the dual cradle arrangement as shown in FIG. **2**, the press operator can quickly change from blanket inking/coating to plate inking/coating within minutes, since it is only necessary to release, remove and reposition or replace the applicator roller **66**.

The capability to simultaneously print in the flexographic mode, the aqueous mode, the waterless mode, or the lithographic mode on different printing units of the same lithographic press and to print or coat from either the plate position or the blanket position on any one of the printing units is referred to herein as the LITHOFLEX™ printing process or system. LITHOFLEX™ is a trademark of Printing Research, Inc. of Dallas, Tex., U.S.A., exclusive licensee of the present invention.

Referring now to FIG. **14**, an inking/coating apparatus **10** having an inking/coating assembly **109** of an alternative design is installed in the upper cradle position for applying ink and/or coating material to a plate P on the plate cylinder **32**. According to this alternative embodiment, an applicator roller **67R** having a resilient transfer surface is coupled to an anilox fluid metering roller which transfers measured amounts of printing ink or coating material to the plate P. The anilox roller **111** has a transfer surface constructed of metal, ceramic or composite material which is engraved with cells. The resilient applicator roller **67R** is interposed in transfer engagement with the plate P and the metering surface of the anilox roller **111**. The resilient transfer surface of the applicator roller **67R** provides uniform, positive engagement with the plate.

Referring now to FIG. **17**, an inking/coating apparatus **10** having an alternative inking/coating assembly **113** is installed in the lower cradle assembly **100** for applying flexographic or aqueous ink and/or coating material Q to a plate or blanket mounted on the blanket cylinder **34**. Instead of using the sealed, dual doctor blade reservoir assembly **68** as shown in FIG. **6**, an open, single doctor blade anilox roller assembly **113** is supplied with liquid ink Q or coating material contained in an open fountain pan **117**. The liquid ink or coating material Q is transferred to the engraved transfer surface of the anilox roller **66** as it turns in the fountain pan **117**. Excess ink or coating material Q is removed from the engraved transfer surface by a single doctor blade **68B**. The liquid ink or coating material Q is pumped from an off-press source, for example the drum **73** shown in FIG. **17**, through a supply conduit **119** into the fountain pan **117** by a pump **120**.

For overall inking or coating jobs, the metering transfer surface of the anilox roller **66** extends over its entire peripheral surface. However, for certain printing jobs which print two or more separate images onto the same substrate, for example work and turn printing jobs, the metering transfer surface of the anilox applicator roller **66** is partitioned by a centrally located, annular undercut groove **66C** which separates first and second metering transfer surfaces **66A**, **66B** as shown in FIG. **11** and FIG. **18**.

The single doctor blade **68B** has an edge **68E** which wipes simultaneously against the split metering transfer surfaces **66A**, **66B**. In this single blade, split anilox roller embodiment **113**, it is necessary to provide dual supply sources, for example drums **73A**, **73B**, dual supply lines **119A**, **119B**, and dual pumps **120A**, **120B**. Moreover, the fountain pan **117** is also split, and the pan **117** is divided into two pan sections **117A**, **117B** by a separator plate **121**, as shown in FIG. **18**. The separator plate **121** is centrally aligned with the undercut groove **66C**, but does not touch the adjoining roller faces.

Although the single blade, split anilox applicator roller assembly **113** is shown mounted in the lower cradle position (FIG. **17**), it should be understood that the single blade, split anilox applicator roller assembly **113** can be mounted and used in the upper cradle position, as well.

According to another aspect of the present invention, the inking/coating apparatus **10** is pivotally coupled on horizontal pivot pins **88P**, **90P** which allows the single head, dual cradle inking/coating apparatus **10** to be mounted on any lithographic printing unit. Referring to FIG. **9**, the horizontal pivot pins **88P**, **90P** are mounted within the traditional dampener space **29** of the printing unit and are secured to the press side frames **14**, **15**, respectively. Preferably, the pivot support pins **88P**, **90P** are secured to the press side frames by a threaded fastener. The pivot support pins are received within circular openings **88**, **90** which intersect the side support members **74**, **76** of the inking/coating apparatus **10**. The horizontal support pins **88P**, **90P** are disposed in parallel alignment with rotational axis X and with the plate cylinder and blanket cylinder, and are in longitudinal alignment with each other.

Preferably, the pivot pins **88P**, **90P** are located in the dampener space **29** so that the rotational axes A1, A2 of the applicator rollers **66**, **67** are elevated with respect to the nip contact points N1, N2. By that arrangement, the transfer point between the applicator roller **66** and a blanket on the blanket cylinder **34** (as shown in FIG. **8**) and the transfer

point between the applicator roller 66 and a plate on the plate cylinder 32 (as shown in FIG. 5) are above the radius lines R1, R2 of the plate cylinder and the blanket cylinder, respectively. This permits the inking/coating apparatus 10 to move clockwise to retract the applicator roller 66 to an off-impression position relative to the blanket cylinder in response to a single extension stroke of the power actuator arms 104A, 106A. Similarly, the applicator roller 66 is moved counterclockwise to the on-impression operative position as shown in FIGS. 4, 5, 6 and 8 by a single retraction stroke of the actuator arms 104A, 106A, respectively.

Preferably, the pivot pins are made of steel and the side support members are made of aluminum, with the steel pivot pins and the aluminum collar portion bordering the circular openings 88, 90 forming a low friction journal. By this arrangement, the inking/coating apparatus 10 is freely rotatable clockwise and counterclockwise with respect to the pivot pins 88P, 90P. Typically, the arc length of rotation is approximately 60 mils (about 1.5 mm). Consequently, the inking/coating apparatus 10 is almost totally enclosed within the dampener space 29 of the printing unit in the on-impression position and in the off-impression position.

The cradle assemblies 100 and 102 position the applicator roller 66 in inking/coating alignment with the plate cylinder or blanket cylinder, respectively, when the inking/coating apparatus 10 is extended to the operative (on-impression) position. Moreover, because the inking/coating apparatus 10 is installed within the dampener space 29, it is capable of freely rotating through a small arc while extending and retracting without being obstructed by the press side frames or other parts of the printing press. This makes it possible to install the inking/coating apparatus 10 on any lithographic printing unit. Moreover, because of its internal mounting position within the dampener space 29, the projection of the inking/coating apparatus 10 into the space between printing units is minimal. This assures unrestricted operator access to the printing unit when the applicator head is in the operative (on-impression) and retracted (off-impression) positions.

As shown in FIG. 4 and FIG. 5, movement of the inking/coating apparatus 10 is counterclockwise from the retracted (off-impression) position to the operative (on-impression) position.

Although the dampener side installation is preferred., the inking/coating apparatus 10 can be adapted for operation on the delivery side of the printing unit, with the inking/coating apparatus being movable from a retracted (off-impression) position to an on-impression position for engagement of the applicator roller with either a plate on the plate cylinder or a blanket on the blanket cylinder on the delivery side 25 of the printing unit.

Movement of the inking/coating apparatus 10 to the operative (on-impression) position is produced by power actuators, preferably double acting pneumatic cylinders 104, 106 which have extendable/retractable power transfer arms 104A, 106A, respectively. The first pneumatic cylinder 104 is pivotally coupled to the press frame 14 by a pivot pin 108, and the second pneumatic cylinder 106 is pivotally coupled to the press frame 15 by a pivot pin 110. In response to selective actuation of the pneumatic cylinders 104, 106, the power transfer arms 104A, 106A are extended or retracted. The power transfer arm 104A is pivotally coupled to the side support member 74 by a pivot pin 112. Likewise, the power transfer arm 106A is pivotally coupled to the side support member 76 by a pivot pin 114.

As the power arms extend, the inking/coating apparatus 10 is rotated clockwise on the pivot pins 88P, 90P, thus moving the applicator roller 66 to the off-impression position. As the power arms retract, the inking/coater apparatus 60 is rotated counterclockwise on the pivot pins 88P, 90P, thus moving the applicator roller 66 to the on-impression position. The torque applied by the pneumatic actuators is transmitted to the inking/coating apparatus 10 through the pivot pin 112 and pivot pin 114.

Fine adjustment of the on-impression position of the applicator roller relative to the plate cylinder or the blanket cylinder, and of the pressure of roller engagement, is provided by an adjustable stop assembly 115. The adjustable stop assembly 115 has a threaded bolt 116 which is engagable with a bell crank 118. The bell crank 118 is pivotally coupled to the side support member 74 on a pin 120. One end of the bell crank 118 is engagable by the threaded bolt 116, and a cam roller is mounted for rotation on its opposite end. The striking point of engagement is adjusted by rotation of the bolt 116 so that the applicator roller 66 is properly positioned for inking/coating engagement with the plate P or blanket B and provides the desired amount of inking/coating pressure when the inking/coating assembly 60 is moved to the operative position.

This arrangement permits the in-line inking/coating apparatus to operate effectively without encroaching in the interunit space between any adjacent printing units, and without blocking or obstructing access to the cylinders of the printing units when the inking/coating apparatus is in the extended (off-impression) position or retracted (on-impression) position. Moreover, when the in-line inking/coating apparatus is in the retracted position, the doctor blade reservoir and coating circulation lines can be drained and flushed automatically while the printing press is running as well as when the press has been stopped for change-over from one job to another or from one type of ink or coating to another.

Substrates which are printed or coated with aqueous flexographic printing inks require high velocity hot air for drying. When printing a flexographic ink such as opaque white or metallic gold, it is always necessary to dry the printed substrates between printing units before overprinting them. According to the present invention, the water component on the surface of the freshly printed or coated substrate S is evaporated and dried by high velocity, hot air interunit dryer and high volume heat and moisture extractor units 124, 126 and 128, as shown in FIG. 2, FIG. 4 and FIG. 5. The dryer/extractor units 124, 126 and 128 are oriented to direct high velocity heated air onto the freshly printed/coated substrates as they are transferred by the impression cylinder 36 and the intermediate transfer drum 40 of one printing unit and to another transfer cylinder 30 and to the impression cylinder 36 of the next printing unit. By that arrangement, the freshly printed flexographic ink or coating material is dried before the substrate S is overprinted by the next printing unit.

The high velocity, hot air dryer and high performance heat and moisture extractor units 124, 126 and 128 utilize high velocity air jets which scrub and break-up the moist air layer which clings to the surface of each freshly printed or coated sheet or web. Within each dryer, high velocity air is heated as it flows across a resistance heating element within an air delivery baffle tube. High velocity jets of hot air are discharged through multiple airflow apertures into an exposure zone Z (FIG. 4 and FIG. 5) and onto the freshly printed/coated sheet S as it is transferred by the impression cylinder 36 and transfer drum 40, respectively.

Each dryer assembly includes a pair of air delivery dryer heads 124D, 126D and 128D which are arranged in spaced,

side-by-side relationship. The high velocity, hot air dryer and high performance heat and moisture extractor units **124**, **126** and **128** are preferably constructed as disclosed in co-pending U.S. patent application Ser. No. 08/132,584, filed Oct. 6, 1993, entitled "High Velocity Hot Air Dryer", to Howard W. DeMoore, co-inventor and assignee of the present invention, and which is incorporated herein by reference, and which is marketed by Printing Research, Inc. of Dallas, Tex., U.S.A., under its trademark SUPER BLUE HV™.

The hot moisture-laden air displaced from the surface of each printed or coated sheet is extracted from the dryer exposure zone Z and exhausted from the printing unit by the high volume extractors **124**, **126** and **128**. Each extractor head includes an extractor manifold **124E**, **126E** and **128E** coupled to the dryer heads **124D**, **126D** and **128D** and draws the moisture, volatiles, odors and hot air through a longitudinal air gap G between the dryer heads. Best results are obtained when extraction is performed simultaneously with drying. Preferably, an extractor is closely coupled to the exposure zone Z at each dryer location as shown in FIG. **4**. Extractor heads **124E**, **126E** and **128E** are mounted on the dryer heads **124D**, **126D** and **128D**, respectively, with the longitudinal extractor air gap G facing directly into the exposure zone Z. According to this arrangement, each printed or coated sheet is dried before it is printed on the next printing unit.

The aqueous water-based inks used in flexographic printing evaporate at a relatively moderate temperature provided by the interunit high velocity hot air dryers/extractors **124**, **126** and **128**. Sharpness and print quality are substantially improved since the flexographic ink or coating material is dried before it is overprinted on the next printing unit. Since the freshly printed flexographic ink is dry, dot gain is substantially reduced and back-trapping on the blanket of the next printing unit is virtually eliminated. This interunit drying/extracting arrangement makes it possible to print flexographic inks such as metallic ink and opaque white ink on the first printing unit, and then dry-trap and overprint on the second and subsequent printing units.

Moreover, this arrangement permits the first printing unit **22** to be used as a coater in which a flexographic, aqueous or UV-curable coating material is applied to the lowest grade substrate such as recycled paper, cardboard, plastic and the like, to trap and seal-in lint, dust, spray powder and other debris and provide a smoother, more durable printing surface which can be overprinted on the next printing unit.

A first down (primer) aqueous coating layer seals—in the surface of a low grade, rough substrate, for example, re-cycled paper or plastic, and improves overprinted dot definition and provides better ink lay-down while preventing strike-through and show-through. A flexographic UV-curable coating material can then be applied downstream over the primer coating, thus producing higher coating gloss.

Preferably, the applicator roller **66** is constructed of composite carbon fiber material, metal or ceramic coated metal when it is used for applying ink or coating material to the blanket B or other resilient material on the blanket cylinder **34**. When the applicator roller **66** is applied to the plate, it is preferably constructed as an anilox roller having a resilient, compressible transfer surface. Suitable resilient roller surface materials include Buna N synthetic rubber and EPDM (terpolymer elastomer).

It has been demonstrated in prototype testing that the inking/coating apparatus **10** can apply a wide range of ink and coating types, including fluorescent (Day Glo), pearlescent, metallics (gold, silver and other metals), glitter, scratch and sniff (micro-encapsulated fragrance), scratch and reveal., luminous, pressure-sensitive adhesives and the like, as well as UV-curable and aqueous coatings.

With the dampener assembly removed from the printing unit, the inking/coating apparatus **10** can easily be installed in the dampener space for selectively applying flexographic inks and/or coatings to a flexographic or waterless printing plate or to the blanket. Moreover, overprinting of the flexographic inks and coatings can be performed on the next printing unit since the flexographic inks and/or coatings are dried by the high velocity, hot air interunit dryer and high volume heat and moisture extractor assembly of the present invention.

The flexographic inks and coatings as used in the present invention contain colored pigments and/or soluble dyes, binders which fix the pigments onto the surface of the substrate, waxes, defoamers, thickeners and solvents. Aqueous printing inks predominantly contain water as a diluent and/or vehicle. The thickeners which are preferred include algonates, starch, cellulose and its derivatives, for example cellulose esters or cellulose ethers and the like. Coloring agents including organic as well as inorganic pigments may be derived from dyes which are insoluble in water and solvents. Suitable binders include acrylates and/or polyvinylchloride.

When metallic inks are printed, the cells of the anilox roller must be appropriately sized to prevent the metal particles from getting stuck within the cells. For example, for metallic gold ink, the anilox roller should have a screen line count in the range of 175–300 lines per inch (68–118 lines per cm). Preferably, in order to keep the anilox roller cells clear, the doctor blade assembly **68** is equipped with a bristle brush BR (FIG. **14**) as set forth in U.S. Pat. No. 5,425,809 to Steven M. Person, assigned to Howard W. DeMoore, and licensed to Printing Research, Inc. of Dallas, Tex., U.S.A., which is incorporated herein by reference.

The inking/coating apparatus **10** can also apply UV-curable inks and coatings. If UV-curable inks and coatings are utilized, ultra-violet dryers/extractors are installed adjacent to the high velocity hot air dryer/extractor units **124**, **126** and **128**, respectively.

It will be appreciated that the LITHOFLEX™ printing process described herein makes it possible to selectively operate a printing unit of a press in the lithographic printing mode while simultaneously operating another printing unit of the same press in either the flexographic printing mode or in the waterless printing mode, while also providing the capability to print or coat, separately or simultaneously, from either the plate position or the blanket position. The dual cradle support arrangement of the present invention makes it possible to quickly change over from inking/coating on the blanket cylinder position to inking/coating on the plate cylinder position with minimum press down-time, since it is only necessary to remove and reposition or replace the applicator roller **66** while the inking/coating apparatus **10** is in the retracted position. It is only necessary to remove four cap screws, lift the applicator roller **66** from the cradle, and reposition it in the other cradle. All of this can be accomplished in a few minutes, without removing the inking/coating apparatus **10** from the press.

It is possible to spot coat or overall coat from the plate position or from the blanket position with flexographic inks or coatings on one printing unit and then spot coat or overall coat with UV-curable inks or coatings from the plate posi-

tion or from the blanket position on another printing unit during the same press run. Moreover, the press operator can spot or overall coat from the plate for one job, and then spot and/or overall coat from the blanket on the next job.

The positioning of the applicator roller relative to the plate or blanket is repeatable to a predetermined preset operative position. Consequently, only minor printing unit modifications or alterations may be required for the LITHOFLEX™ process. Although automatic extension and retraction have been described in connection with the exemplary embodiment, extension to the operative (on-impression) position and retraction to a non-operative (off-impression) position can be carried out manually, if desired. In the manual embodiment, it is necessary to latch the inking/coating apparatus 10 to the press side frames 14, 15 in the operative (on-impression) position, and to mechanically prop the inking/coating apparatus in the off-impression (retracted) position.

Referring again to FIG. 8, an applicator roller 66 is mounted on the lower cradle assembly 100 by side support members 78, 80, and a second applicator roller 67 is mounted on the upper cradle assembly 102 by side support members 82, 84. According to this arrangement, the inking/coating apparatus 10 can apply printing ink and/or coating material to a plate on the plate cylinder, while simultaneously applying printing ink and/or coating material to a plate or a blanket on the blanket cylinder of the same printing unit. When the same color ink is used by the upper and lower applicator rollers from the plate position and from the blanket position simultaneously on the same printing unit, a "double bump" or double inking films or coating layers are applied to the substrate S during a single pass of the substrate through the printing unit. The tack of the two inks or coating materials must be compatible for good transfer during the double bump. Moreover, the inking/coating apparatus 10 can be used for supplying ink or coating material to the blanket cylinder of a rotary offset web press, or to the blanket of a dedicated coating unit.

According to conventional bronzing techniques, a metallic (bronze) powder is applied off-line to previously printed substrate which produces a grainy, textured finish or appearance. The on-line application of bronze material by conventional flexographic or lithographic printing will only produce a smooth., continuous appearance. However, a grainy, textured finish is preferred for highest quality printing which, prior to the present invention, could only be produced by off-line methods.

Referring now to FIG. 14 and FIG. 15, metallic ink or coating material is applied on-line to the substrate S by simultaneous operation of the upper and lower applicator rollers 67R, 66 to produce an uneven surface finish having a bronze-like textured or grainy appearance. According to the simulated bronzing method of the present invention, the flexographic bronze ink is applied simultaneously to the plate and to the blanket by the dual cradle inking/coating apparatus 10 as shown in FIG. 14. A resilient applicator roller 67R is mounted in the upper cradle 102, and an anilox applicator roller 66 is mounted on the lower cradle 100. The rollers are supplied from separate doctor blade reservoirs 70. The doctor blade reservoir 70 in the upper cradle position supplies bronze ink or coating material having relatively coarse, metallic particles 140 dispersed in aqueous or flexographic ink. The coarse particle ink or coating material is applied to the plate P by the resilient applicator roller 67R in the upper cradle position 102. At the same time, flexographic and/or bronze ink or coating material having relatively fine, metallic particles 142 is transferred to the blanket B by the anilox roller 66 which is mounted on the lower cradle 100.

The metering surfaces of the upper and lower applicator rollers have different cell sizes and volumetric capacities which accommodate the coarse and fine metallic particles. For example, the anilox roller 111 mounted in the upper cradle position 102 which transfers the coarse metallic particles 140 preferably has a screen line count in the range of 100–300 lines per inch (39–118 lines per cm), and the metering surface of the anilox roller 66 mounted on the lower cradle 100 which transfers the relatively fine metallic particles 142 preferably has a screen line count in the range of 200–600 lines per inch (79–236 lines per cm).

After transfer from the plate to the blanket, the fine metallic particles 142 form a layer over the coarse metallic particles 140. As both bronze layers are offset onto the substrate S, the layer of fine metallic particles 142 is printed onto the substrate S with the top layer of coarse metallic particles 140 providing a textured, grainy appearance. The fine metallic particles 142 cover the substrate which would otherwise be visible in the gaps between the coarse metallic particles 140. The combination of the coarse particle layer over the fine particle layer thus provides a textured, bronzed-like finish and appearance.

Particulate materials other than metal can be used for producing a textured finish. For example, coarse and fine particles of metallized plastic (glitter), mica particles (pearlescent) and the like, can be substituted for the metallic particles for producing unlimited surface variations, appearances and effects. All of the particulate material, including the metallic particles, are preferably in solid, flat platelet form, and have a size dimension suitable for application by an anilox applicator roller. Other particulate or granular material, for example stone grit having irregular form and size, can be used to good advantage.

Solid metal particles in platelet form, which are good reflectors of light, are preferred for producing the bronzed-like appearance and effect. However, various textured finishes, which could have light-reflective properties, can be produced by using granular materials such as stone grit. Most commonly used metals include copper, zinc and aluminum. Other ductile metals can be used, if desired. Moreover, the coarse and fine particles need not be made of the same particulate material. Various effects and textured appearances can be produced by utilizing diverse particulate materials for the coarse particles and the fine particles, respectively. Further, either fine or coarse particle ink or coating material can be printed from the upper cradle position, and either fine or coarse particle ink or coating material can be printed from the lower cradle position, depending on the special or surface finish that is desired.

It will be appreciated that the last printing unit 28 can be configured for additional inking/coating capabilities which include lithographic, waterless, aqueous and flexographic processes. Various substrate surface effects (for example double bump or triple bump inking/coating or bronzing) can be performed on the last printing unit. For triple bump inking/coating, the last printing unit 28 is equipped with an auxiliary in-line inking or coating apparatus 97 as shown in FIG. 3 and FIG. 4. The in-line inking or coating apparatus 97 allows the application of yet another film of ink or a protective or decorative layer of coating material over any freshly printed or coated surface effects or special treatments, thereby producing a triple bump. The triple bump is achieved by applying a third film of ink or layer of coating material over the freshly printed or coated double bump simultaneously while the substrate is on the impression cylinder of the last printing unit.

When the in-line inking/coating apparatus 97 is installed, it is necessary to remove the SUPER BLUE® flexible

covering from the delivery cylinder 42, and it is also necessary to modify or convert the delivery cylinder 42 for inking/coating service by mounting a plate or blanket B on the delivery cylinder 42, as shown in FIG. 3 and FIG. 4. Packing material is placed under the plate or blanket B, thereby packing the plate or blanket B at the correct packed-to-print radial clearance so that ink or coating material will be printed or coated onto the freshly printed substrate S as it transfers through the nip between the plate or blanket B on the converted delivery cylinder 42 and the last impression cylinder 36. According to this arrangement, a freshly printed or coated substrate is overprinted or overcoated with a third film or layer of ink or coating material simultaneously while a second film or layer of ink or coating material is being over-printed or over-coated on the last impression cylinder 36.

The auxiliary inking/coating apparatus 97 and the converted or modified delivery cylinder 42 are mounted on the delivery drive shaft 43. The inking/coating apparatus 97 includes an applicator roller, preferably an anilox applicator roller 97A, for supplying ink or coating material to a plate or blanket B on the modified or converted delivery cylinder 42. The in-line inking/coating apparatus 97 and the modified or converted delivery cylinder 42 are preferably constructed as described in U.S. Pat. No. 5,176,077 to Howard W. DeMoore (co-inventor and assignee), which is hereby incorporated by reference. The in-line inking/coating apparatus 97 is manufactured and sold by Printing Research, Inc. of Dallas, Tex., U.S.A., under its trademark SUPER BLUE EZ COATER™.

After the delivery cylinder 42 has been modified or converted for inking/coating service, and because of the reduced nip clearance imposed by the plate or blanket B, the modified delivery cylinder 42 can no longer perform its original function of guiding and transferring the freshly printed or coated substrate. Instead, the modified or converted delivery cylinder 42 functions as a part of the inking/coating apparatus 97 by printing or coating a third down film of ink or layer of coating material onto the freshly printed or coated substrate as it is simultaneously printed or coated on the last impression cylinder 36. Moreover, the mutual tack between the second down ink film or coating layer and the third down ink film or coating layer causes the overprinted or overcoated substrate to cling to the plate or blanket, thus opposing or resisting separation of the substrate from the plate or blanket.

To remedy this problem, a vacuum-assisted transfer apparatus 99 is mounted adjacent the modified or converted delivery cylinder 42 as shown in FIG. 3 and FIG. 4. Another purpose of the vacuum-assisted transfer apparatus 99 is to separate the freshly overprinted or overcoated triple bump substrate from the plate or blanket B as the substrate transfers through the nip. The vacuum-assisted transfer apparatus 99 produces a pressure differential across the freshly overprinted or overcoated substrate as it transfers through the nip, thus producing a separation force onto the substrate and providing a clean separation from the plate or blanket B.

The vacuum-assisted transfer apparatus 99 is preferably constructed as described in U.S. Pat. Nos. 5,113,255; 5,127,329; 5,205,217; 5,228,391; 5,243,909; and 5,419,254, all to Howard W. DeMoore, co-inventor, which are incorporated herein by reference. The vacuum-assisted transfer apparatus 99 is manufactured and sold by Printing Research, Inc. of Dallas, Tex., U.S.A. under its trademark BACVAC®.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. A method for printing in a rotary offset press of the type including first and second printing units, the first printing unit having a flexographic printing plate, a blanket, an impression cylinder and inking/coating applicator means for applying aqueous or flexographic printing ink or coating material to the flexographic printing plate and/or to the blanket, comprising the following steps performed in succession in the first printing unit:

applying a first spot or overall coating of aqueous or flexographic printing ink or coating material to the flexographic printing plate;

transferring the aqueous or flexographic printing ink or coating material from the flexographic printing plate to the blanket;

applying a second spot or overall film of aqueous or flexographic printing ink or-layer of coating material to the blanket;

transferring ink or coating material from the blanket to a substrate as the substrate is transferred through the nip between the blanket and the impression cylinder; and,

drying the aqueous or flexographic ink or coating material on the freshly printed or coated substrate before the substrate is printed, coated or otherwise processed on the second printing unit.

2. The printing method as defined in claim 1, including the steps:

applying a primer coating of an aqueous or flexographic ink or coating material to a substrate in the first printing unit;

trapping and sealing particulate material such as dust, lint, anti-offset spray powder and the like under the primer coating;

drying the primer coating on the substrate before the substrate is printed or coated on the second printing unit; and,

overprinting the freshly coated substrate in the second printing unit.

3. The printing method as defined in claim 1,

wherein the drying step is performed by directing heated air onto the freshly printed or coated substrate while the freshly printed or coated substrate is in contact with the impression cylinder of the first printing unit.

4. The printing method as defined in claim 1, including the steps:

transferring the freshly printed or coated substrate to an intermediate transfer cylinder disposed between the first and second printing units; and,

drying the freshly printed or coated substrate while said substrate is in contact with the intermediate transfer cylinder.

5. The printing method as defined in claim 1, wherein:

the drying step is performed by directing heated air onto the freshly printed or coated substrate while the freshly printed or coated substrate is in contact with an impression cylinder in the second printing unit.

6. The printing method as defined in claim 1, wherein the drying step is performed by directing heated air from a dryer onto the freshly printed or coated substrate, and including the step:

extracting hot air, moisture and volatiles from an exposure zone between the freshly printed or coated substrate

and the dryer while the freshly printed or coated substrate is in contact with the impression cylinder of the first printing unit.

7. The printing method as defined in claim 1, including the steps:

transferring the freshly printed or coated substrate to an intermediate transfer cylinder disposed between the first and second printing units;

directing heated air from a dryer onto the freshly printed or coated substrate while said substrate is in contact with the intermediate transfer cylinder; and,

extracting hot air, moisture and volatiles from an exposure zone between the freshly printed or coated substrate and said dryer while the freshly printed or coated substrate is in contact with the intermediate transfer cylinder.

8. The printing method as defined in claim 1, including the steps:

transferring the freshly printed or coated substrate to an impression cylinder on the second printing unit;

directing heated air from a dryer onto the freshly printed or coated substrate while said substrate is in contact with the impression cylinder of the second printing unit; and,

extracting hot air, moisture and volatiles from an exposure zone between the freshly printed or coated substrate and said dryer while said substrate is in contact with the impression cylinder of the second printing unit.

9. A method for providing an uneven printed or coated layer on a substrate in a rotary offset printing press of the type including a printing unit having a plate cylinder, a flexographic printing plate mounted on the plate cylinder, a blanket cylinder, a plate or blanket mounted on the blanket cylinder, an impression cylinder and applicator means for applying aqueous or flexographic printing ink or coating material to the flexographic printing plate and/or to the plate or blanket on the blanket cylinder, comprising the following steps performed in succession in the printing unit:

applying a first down layer of aqueous or flexographic ink or coating material containing relatively coarse particles to the flexographic plate;

transferring the relatively coarse particle printing ink or coating material from the flexographic printing plate to the plate or blanket on the blanket cylinder;

applying a second down layer of aqueous or flexographic printing ink or coating material containing relatively fine particles onto the relatively coarse particle printing ink or coating material;

transferring the coarse and fine particle ink or coating material from the blanket or plate on the blanket cylinder onto a substrate as the substrate is transferred through the nip between the blanket cylinder and the impression cylinder; and,

drying the freshly printed or coated substrate before the freshly printed or coated substrate is subsequently printed, coated or otherwise processed.

10. The method as set forth in claim 9, wherein the coarse and fine particles comprise a metal selected from the group including copper, zinc and aluminum.

11. The method as set forth in claim 9, wherein the coarse and fine particles comprise a non-metallic material selected from the group consisting of mica, silicon, stone grit and plastic.

12. The method as set forth in claim 9, wherein the coarse and fine particles comprise diverse particulate materials, respectively.

13. A method for printing or coating a substrate on the last printing unit of a rotary offset printing press of the tape including a plate cylinder, a printing plate mounted on the plate cylinder, a blanket cylinder, a plate or blanket mounted on the blanket cylinder, an impression cylinder, inking/coating apparatus for applying printing ink or coating material simultaneously or separately to the flexographic printing plate and/or to the plate or blanket on the blanket cylinder, and including an inking/coating cylinder mounted adjacent the last printing unit for printing a film of ink or layer of coating material over a freshly printed substrate, comprising the steps:

applying a first down film of printing ink or layer of coating material to the printing plate;

transferring printing ink or coating material from the printing plate to a plate or blanket on the blanket cylinder;

applying a second down film of printing ink or layer of coating material over the first down film or layer on the plate or blanket on the blanket cylinder;

transferring ink or coating material from the blanket or plate on the blanket cylinder onto a substrate as the substrate is transferred through the nip between the blanket cylinder and the impression cylinder; and

simultaneously printing a third down film of printing ink or layer of coating material over the second down film of ink or layer of coating material while the second down film or layer is being printed or coated on the last impression cylinder.

14. A method for printing or coating a substrate in a rotary offset printing press of the type including a printing unit having a plate cylinder, a flexographic printing plate mounted on the plate cylinder, a blanket cylinder, a plate or blanket mounted on the blanket cylinder, an impression cylinder, and inking/coating apparatus for applying flexographic or aqueous printing ink or coating material to the flexographic printing plate and/or to the plate or blanket on the blanket cylinder, comprising the following steps:

applying a first down film or layer of flexographic or aqueous printing ink or coating material to the flexographic printing plate;

transferring printing ink or coating material from the flexographic printing plate to the plate or blanket on the blanket cylinder;

applying a second down film or layer of aqueous or flexographic printing ink or coating material over the first dowel film or layer on the plate or blanket on the blanket cylinder;

transferring ink or coating material from the blanket or plate on the blanket cylinder onto a substrate as the substrate is transferred through the nip between the blanket cylinder and the impression cylinder; and,

drying the freshly printed or coated substrate before the substrate is subsequently printed, coated or otherwise processed.

15. A method of printing or coating a substrate in a rotary offset printing press as set forth in claim 14, wherein the printing unit is the last printing unit of the rotary offset printing press and a delivery cylinder is mounted on the last printing unit for transferring the freshly printed substrate along a substrate travel path, including the steps:

modifying the delivery cylinder by mounting a plate or blanket on the delivery cylinder;

transferring ink or coating material to the plate or blanket on the modified delivery cylinder; and

transferring a third down film or layer of aqueous or flexographic printing ink or coating material from the plate or blanket over the second down film or layer simultaneously while the freshly printed or coated substrate is on the last impression cylinder of the last printing unit.

16. A method for rotary offset printing as defined in any one of claims 1, 9, 13 or 14, including the steps:

circulating liquid ink or coating material from a supply container to said inking/coating applicator means and from said inking/coating applicator means to the supply container; and,

heating or cooling the liquid ink or coating material as it is circulated.

* * * * *

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Aug. 20, 1968 J. DE LIGT 3,397,675

COATING APPARATUS

Filed March 13, 1967

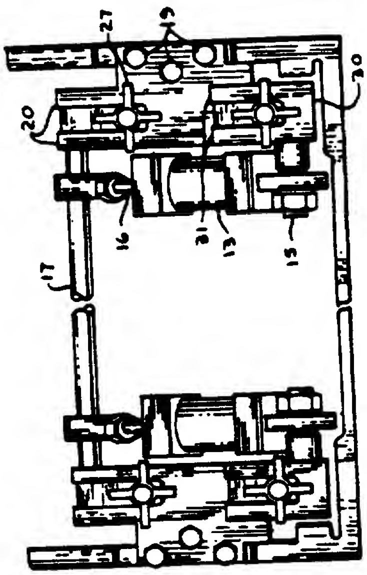

Fig. 2

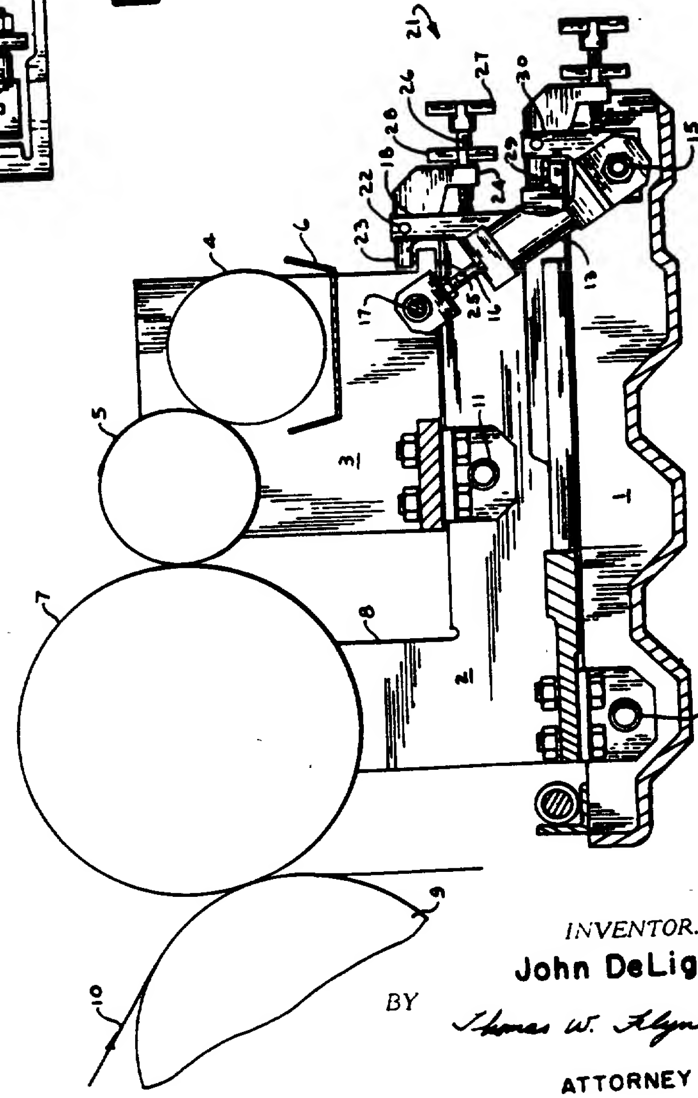

Fig. 1

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3,397,675

Patented Aug. 20, 1968

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3,397,675

COATING APPARATUS

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Filed Mar. 13, 1967, Ser. No. 622,691
3 Claims. (Cl. 118—258)

ABSTRACT OF THE DISCLOSURE

A coating or printing station having its applicator and transfer rolls attached to pivotally mounted supporting frames so that the rolls may be moved into and out of operative position. Adjustable, lost motion stops are provided interconnecting the supporting frames so that the frames may be pivoted serially by means of a single source of power and the operative positions of the rollers preset by adjusting the stops.

BACKGROUND OF THE INVENTION

Field of the invention.—Actuating systems for moving the rollers of a rotary coater or printer into and out of operative positions.

Description of the prior art.—In a conventional form of rotary coater or printer, the coating material is picked up from a supply tray or pan by a pickup roll and distributed by the pickup roller over the surface of a transfer roller. The transfer roller then transfers a layer of coating to an applicator roll which applies the coating to a web of material carried past the applicator roller by a backup roll.

In practice, the pickup and applicator rolls may be resiliently surfaced and the transfer roll provided with a relatively hard etched surface. Depending upon the surface configuration of the applicator roll, the coating may be applied to the web in either a continuous or patterned layer. In this regard it should be noted that the terms coater, coating and the like are used herein in their generic

In this type of operation it is necessary to maintain a continuous layer or coating.

In this type of operation it is necessary to maintain a desired pressure or spacing, between the web being treated and the applicator roll and between each of the rolls. It is also desirable to be able to withdraw the applicator roll from the web and at least the transfer roll from the applicator roll when the coating operation is temporarily discontinued and to return the rolls to exactly their former positions when coating is again commenced. Additionally, it is necessary that these pressures or spacings be capable of adjustment to suit the requirements of specific operations.

In a known form of actuating system intended to accomplish these results, the frames for the applicator and transfer rolls are each mounted on trackways and an eccentrically mounted shaft, actuated by a hydraulically powered linkage system, is provided for each frame to slide the frames along their respective trackways and thereby move the rolls into and out of their operative positions.

It will be apparent that in this type of actuating system the contacting portions of the frames and trackways must be finished with precision and maintained in this condition to insure a smooth sliding action. It will also be apparent that the provision of separate, hydraulically actuated linkages and eccentrically mounted shafts for each frame will be both relatively expensive to construct and a ready source of malfunction.

Of equal importance, it has been found that some degree

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of play is almost inherent in this type of actuating system and that, almost invariably, when the frames are moved into operative position after a temporary discontinuance of the coating operation, the pressures or spacings between the rolls and the web, which had been set before discontinuance of the operation, have changed. Hence, upon resumption of coating it is usually necessary to readjust the positions of the rollers until an acceptable coating on the web being treated is obtained. Not only does this result in lost production time, but the web and coating material used in making these adjustments are wasted.

SUMMARY

In accordance with the present invention an actuating system is provided which permits the applicator and transfer rolls to be set to their desired operating pressures or spacings. When it becomes necessary to stop the coating operation, the frames on which the rolls are mounted are pivoted rearwardly, withdrawing the rolls from the work piece.

Upon resumption of coating, force is applied directly to the transfer roll frame causing it to tilt forward and move the transfer roller evenly toward the applicator roll. An adjustable, lost motion stop engages the transfer roll frame when the transfer roll has moved to the spacing or pressure value with the applicator roll which had been maintained before interruption of the coating operation. When the transfer roller has been moved to its desired position with respect to the applicator roll, continued application of force to the transfer roll frame is transmitted through the stop member to the applicator roll frame causing this frame to tilt forward about its pivot and carry the applicator roll towards the work piece. A second, adjustable, lost motion stop mounted on the base frame then engages the applicator roll frame when that frame has pivoted to a position such that the applicator roll is brought into its desired position with respect to the workpiece.

The two stops and the force applied to the transfer roll frame then serve to maintain the frames, and the rolls carried thereby, in their operative positions until it is again desired to discontinue the coating operation at which time the force applied to the transfer roll frame is relaxed and the frames allowed to pivot rearwardly and withdraw the rolls from their operative positions.

It will be seen that with the present apparatus the need for precision finished trackways is eliminated.

It will also be seen that by pivoting the frames rather than sliding them, the frames are always moved evenly into and out of position and the danger of the rolls becoming skewed is obviated.

It will also be seen that force need only be applied to the transfer roll frame since that force is also transmitted through the stop members to the applicator roll frame. Thus, the need for separate actuating systems for each roll is eliminated.

Additionally, through the use of pivoted frames and adjustable stops not only are the rather complicated, dual actuating systems replaced, but the rolls are precisely placed in their desired positions with respect to each other and the workpiece.

Further, by use of the lost motion stops, the rolls are moved serially into their respective positions by a single continuous application of force. Thus, the transfer roller is first moved into its desired position with respect to the applicator roll, causing coating to be transferred thereto, then the entire assembly of rolls is moved as a unit until the applicator roll is in its desired position and coating the workpiece.

These and other objects and advantages will become more readily apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a vertical cross-sectional view through a printing or coating station embodying principles of the present invention; and

FIGURE 2 is a rear elevational view thereof.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIGURE 1, it will be seen that the coating or printing station comprises a base frame 1, an applicator roll frame 2, and a transfer roll frame 3. Both sides of the printing or coating station are identical and in the following description one side only will be described; it being understood that the opposite side thereof is the same as that described.

Frame 3 carries a pickup roll 4 and a transfer roll 5, rotatably mounted thereon, with the lower portion of the pickup 4 rotating in a pan or tray 6, which will contain a supply of the coating material.

Applicator roll frame 2 is of substantially reversed L-shape, as seen in FIGURE 1, and carries the applicator roll 7 rotatably mounted between its upright legs 8. Positioned adjacent the applicator roll 7 is a backup roller 9, which carries a web 10 of the material to be treated past the printing or coating station. Frame 3 overlies frame 2 and is pivotally attached thereto, as at 11, and frame 2, in turn, is carried by the base frame 1 and is pivotally attached thereto, as at 12, with the axes of all rollers and pivot points parallel to each other.

Adjacent the rear end of frame 1 a cylinder 13 is pivotally attached, as at 15, and slideably receives a piston carrying a piston rod 16, which in turn, is pivotally attached at its outer end to frame 3 by means of a pivot shaft 17 extending between opposite sides of the frame.

As seen in FIGURES 1 and 2, a clevis member 18 is fixed to the rear end of frame 2, by bolts 19 or the like, and has upstanding, spaced, parallel legs 20. An adjustable, lost motion stop 21 is positioned between the upstanding legs 20 of the clevis and is pivotally attached thereto, as at 22. The stop 21 comprises a substantially horizontally extending leg 23 and a substantially vertically extending leg 24, with the leg 23 overlying a rearwardly projecting shoulder 25 of the frame 3. A threaded adjusting member 26 extends through the leg 24 of stop 21 and has a handle 27 for moving the adjusting screw 26 inwardly and outwardly of the leg 24. A lock nut 28 is also provided for locking the adjusting member 26 in position.

Frame 2 is also provided with a rearwardly extending shoulder 29, and, attached to the rear end of base frame 1 is a second clevis member 30, having upstanding legs 31. An adjustable lost motion stop member 21, identical to that described above, is also provided, pivotally mounted between the upstanding legs 31 of clevis 30.

In its inoperative position, frame 2 wil be resting on frame 1 and frame 3 will be resting on frame 2 with the lower surface of arm 23 spaced from the upper surface of shoulder 25 and the upper surface of shoulder 29 spaced from the lower surface of the leg 23 adjacent thereto. In this position, roll 5 will be spaced from roll 7, and roll 7 will be spaced from roll 9 and the web 10 of material carried thereby. The spacing between shoulders 25 and 29 and the respective legs 23 of adjacent stops 21 will be determined by the extent to which the adjusting members are threaded through the legs 24 of the stop members.

With the components of the coater in their inoperative positions, as described above, when it is desired to resume the coating operation, cylinder 13 is pressurized, causing the piston 16 to extend outwardly thereof. This will cause the frame 3 to pivot about point 11 until the upper surface of the shoulder 25 engages the lower surface of adjacent leg 23. At this point the axes of rolls 5 and 7 will be in their desired positions with respect to each other.

Continued extension of the piston 16 from the cylinder 13 will cause the pivoting force applied to the frame 3 to be transmitted by the shoulder 25 and stop member 21 to the frame 2; causing this frame to pivot about point 12. Frame 2 will then pivot about point 12 until the upper surface of its shoulder 29 contacts the lower surface of the adjacent overlying leg 23. At this point, the axes of rollers 7 and 9 will be at their desired spacing and coating or printing will be applied to the web 10.

The rollers 7 and 5 will remain in their operative positions as long as sufficient pressure is maintained in the cylinder 13. When it is desired to temporarily discontinue the coating operation, the pressure in cylinder 13 is relaxed and the frames 2 and 3, and the rolls 7 and 5, respectively, are allowed to move rearawrdly to their inoperative positions. When it is again desired to commence coating, the cylinder 13 is once again pressurized and the rollers 7 and 5 move, as described above, into their former positions.

It will be seen that because the movement of frames 2 and 3 is a pivotal motion, the rolls 7 and 5 mounted thereon will always move with their axes parallel to the original positions thereof and skewing of the rolls is obviated. Additionally, since the stops 21, locked in position by the lock nuts 28, provide a positive stop between adjacent frames, the rolls, when tilted forward, will always move into exactly the same position they occupied prior to interruption of the coating operation.

Thus, not only does the present invention eliminate the complicated dual actuating system of the prior art, but a system is provided which insures that the rolls will be positively moved into and out of their operative positions.

While a preferred embodiment of the invention has been described for purposes of illustration, it will be apparent that modifications thereof will occur to those skilled in the art within the scope of the appended claims.

I claim:

1. A coating or printing station comprising:

(a) a base frame,

(b) a substantially L-shaped frame overlying said base frame and pivotally attached to said base frame adjacent the intersection of the legs of said L-shaped frame,

(c) an applicator roller rotatably mounted between the upstanding legs of said L-shaped frame,

(d) a transfer roller frame overlying said L-shaped frame and pivotally attached thereto,

(e) a transfer roller rotatably mounted on said transfer roller frame,

(f) the axes of said rollers and the pivotal connections being substantially parallel,

(g) a first clevis member having a pair of spaced upstanding legs mounted on said base frame,

(h) a first L-shaped member pivotally mounted between said legs of said first clevis with one leg of said first L-shaped member extending substantially horizontally in spaced relation to a rearwardly projecting shoulder on said L-shaped frame and the other leg thereof extending substantially vertically in spaced relation to said base frame,

(i) an adjusting screw threaded through said vertically extending legs of said first L-shaped member and bearing at one end against said base frame,

(j) a second clevis member having a pair of spaced upstanding legs mounted on said L-shaped frame,

(k) a second L-shaped member pivotally mounted between said legs of said second clevis with one leg of said second L-shaped member extending substantially horizontally in spaced relation to a rearwardly projecting shoulder on said transfer roller frame and the other leg thereof extending substantially vertically in spaced relation to said L-shaped frame,

(l) an adjusting screw threaded through said vertically extending leg of said first L-shaped member and bearing at one end against said L-shaped frame,

(m) a cylinder pivotally attached at one end to said base frame, and

(n) a piston slideably received in said cylinder and having a piston rod pivotally attached to said transfer roll frame.

2. A coater or printing station comprising:
(a) a first pivotally mounted frame having a roll rotatably mounted thereon,
(b) a second pivotally mounted frame having a roll rotatably mounted thereon,
(c) the axes of said rolls and the pivotal connections of said frames extending in parallel relationship to each other,
(d) a first lost motion stop mounted on said first frame and comprising:
  (i) a clevis having a pair of spaced legs,
  (ii) a substantially L-shaped member pivotally mounted between said clevis legs with one leg of said L-shaped member overlying a portion of said first frame and the other leg of said L-

shaped member overlying a portion of said second frame, and
(e) means for applying a pivoting force to said second frame.

3. The apparatus of claim 2 further comprising:
(a) means for varying the spacing between the legs of L-shaped member and adjacent portions of said frames.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,397,675 August 20, 1968

John De Ligt

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 42, "In this type of operation it is necessary to maintain a" should read -- sense to cover printing as well as the application of a --. Column 2, line 32, after "frame" insert a semicolon; line 43, after "operation" insert a semicolon; line 67, after "then" insert a comma. Column 3, line 39, after "21" insert a comma; line 55, "wil" should read -- will --. Column 4, line 14, "rearawrdly" should read -- rearwardly --; line 72, "first" should read -- second --.

Signed and sealed this 3rd day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents

24

March 18, 1969 R. K. NORTON 3,433,155

MECHANISM FOR APPLYING A COATING TO A PLATE

Filed Sept. 13, 1965 Sheet 1 of 2

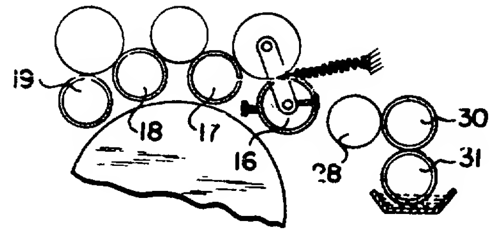

FIG. 2

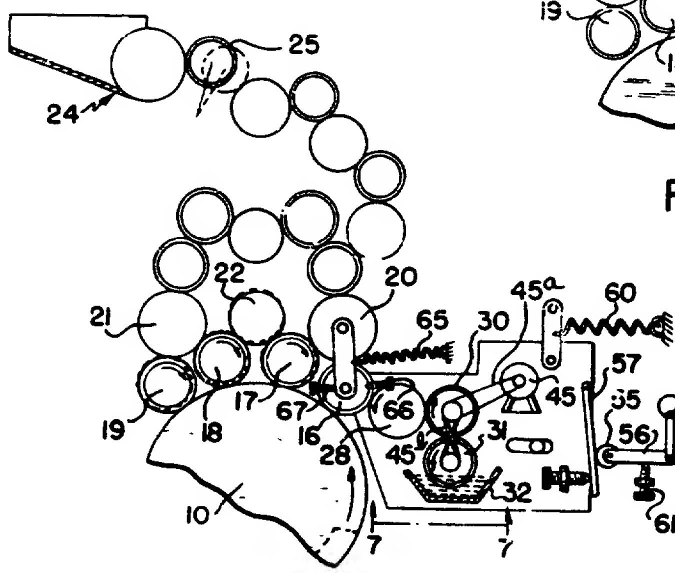

FIG. 1

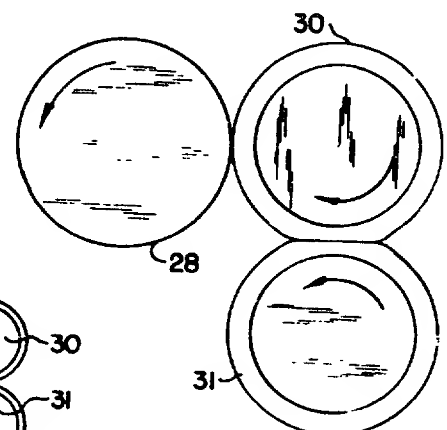

FIG. 4

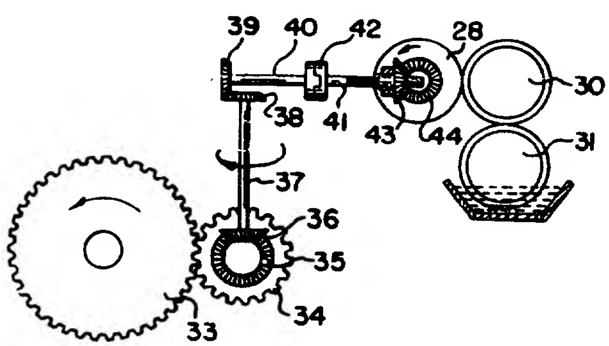

FIG. 3

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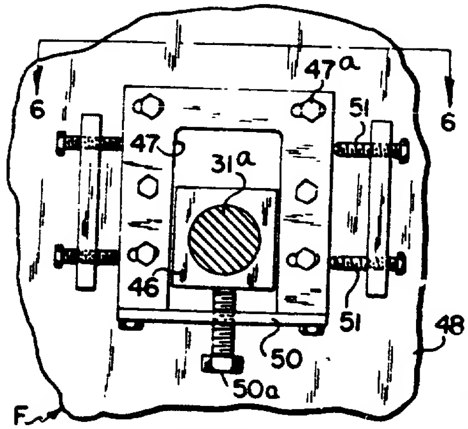

FIG.5

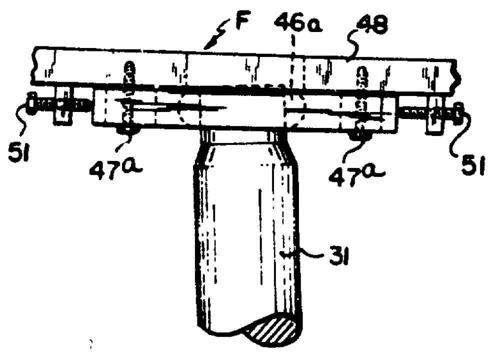

FIG.6

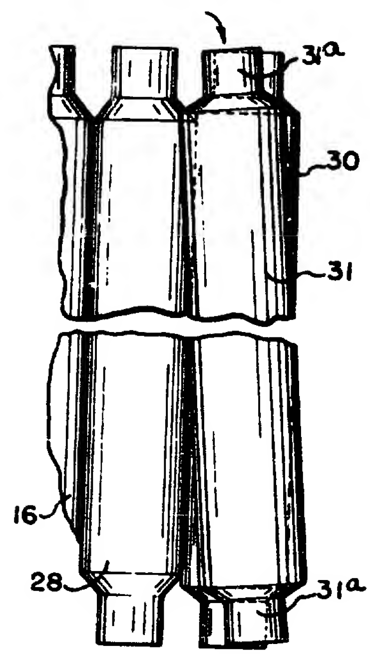

FIG.7

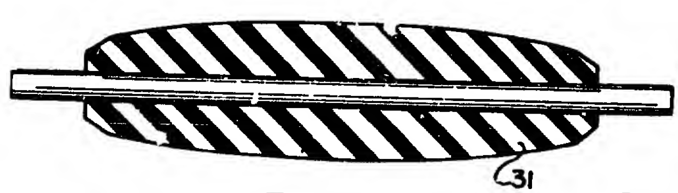

FIG.8

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United States Patent Office

3,433,155

Patented Mar. 18, 1969

3,433,155

MECHANISM FOR APPLYING A COATING TO A PLATE

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Filed Sept. 13, 1965, Ser. No. 486,680

U.S. Cl. 101—148 8 Claims

Int. Cl. B41l 23/04, 25/02; B41f 31/14

ABSTRACT OF THE DISCLOSURE

A dampening mechanism for applying a dampening fluid to the surface of a rotating printing plate of a printing press is disclosed. The dampening mechanism comprises a form roll driven by the printing plate, a hard surface, hydrophilic roll for transferring dampening fluid to the form roll, a resilient metering roll running in pressure engagement with the hydrophilic roll for transferring the dampening fluid to the hydrophilic roll and a resilient pan roll for transferring dampening fluid from a supply to the metering roll. The hard surface, hydrophilic roll is positively rotated to have the same surface speed as the rotating printing plate and the resilient metering roll is driven at a speed which is adjustable to adjust the relative surface speeds between the hard surface, hydrophilic roll and the resilient metering roll to control the amount of dampening fluid delivered to the hydrophilic roll.

The present invention relates to a printing press or other apparatus in which a rotating applicator such as a form roll applies a fluid material, e.g., ink, dampening fluid, or both, to the surface of a printing plate or the like.

An important object of the present invention is to provide a new and improved lithographic printing press having a dampening mechanism in which the flow of dampening fluid is controlled by varying the relative surface speed of cooperating rolls in the dampening mechanism and in which the dampening mechanism includes a positively driven roll which runs in engagement with a form roll, the driven roll being driven at the surface speed of the plate to minimize the effect of scumming on the plate.

Another object of the present invention is to provide a new and improved lithographic printing press wherein the printing plate has dampening fluid applied thereto by a form roll frictionally driven from the plate with dampening fluid being supplied to the form roll from a positively driven hard surface transfer roll whose surface speed is the same as the surface speed of the plate cylinder and in which the dampening fluid on the hard surface transfer roll is controlled by varying the speed of a resilient surface running in pressure engagement with the hard surface transfer roll.

Another object of the present invention is to provide a new and improved lithographic printing press in which dampening fluid being fed to the printing press is first metered by a roll running in pressure relationship with a variable speed roll having a resilient surface with the amount of fluid being transferred by the dampening mechanism being controlled by varying the speed of the variable speed roll to vary the surface speed between the variable speed roll and a positively driven hard surface hydrophilic roll rotating at a predetermined surface speed, preferably at the surface speed of the plate.

Still another object of the present invention is to provide a new and improved lithographic printing press in which a dampening mechanism for feeding dampening fluid to the printing press has the dampening fluid

metered and smoothed out by a resilient surface roll which operates as a pan roll and delivers dampening fluid to a cooperating roll having a resilient surface with the surface speed of the cooperating roll and the pan roll being the same but variable to vary the amount of dampening fluid transferred to a hard surface roll running in pressure engagement with the cooperating roll and having a predetermined surface speed.

Yet another object of the persent invention is to provide a new and improved printing press in which a dampening fluid is transferred by a plurality of rolls from a supply therefor to a printing plate and wherein the distribution and amount of dampening fluid is controlled by varying the speed of a roll having a resilient surface to change its surface speed relatively to a hard surface roll with which it has a pressure engagement.

The present invention also contemplates the provision of a new and improved apparatus embodying at least three rolls for feeding fluid material to a rotating applicator in which apparatus a first resilient surface roll controls the transfer of fluid material to a second resilient surface roll which runs in pressure relationship therewith with the surface speed of the resilient surface rolls being the same but variable relative to the speed of a hard surface transfer roll which receives the material from the variable speed transfer roll.

A still further object of the present invention is to provide a new and improved apparatus for applying a coating of fluid material to a moving surface in which a rotating applicator roll for applying the coating is rotated at a surface speed of the moving surface by frictional engagement of the moving surface and by the frictional engagement of roll means running in contact with the periphery of the applicator roll, and in which fluid material is supplied to the applicator roll from a supply therefor by a plurality of rolls including one running at a surface speed different from the surface speed of the moving surface, the plurality of rolls being arranged and driven in a manner such that there is little or no tendency of the applicator roll to slow when not engaged with the moving surface due to the drag of the roll which runs at a different surface speed.

Further objects and advantages of the present invention will be apparent from the following detailed description thereof made with reference to the accompanying drawings forming a part of the present specification and in which:

FIG. 1 is a diagrammatic view showing a portion of a printing press embodying the present invention;

FIG. 2 is a view which corresponds to a portion of FIG. 1 showing certain parts thereof in different positions;

FIG. 3 is a view, somewhat diagrammatic, of a drive for one of the dampening rolls of the apparatus shown in FIG. 1;

FIG. 4 is an enlarged view showing the relationship of three of the dampening rolls of the apparatus shown in FIG. 1;

FIG. 5 is a fragmentary view showing a bearing mounting for one of the rolls of the apparatus shown in FIG. 1;

FIG. 6 is a view taken from approximately line 6—6 of FIG. 5 looking in the direction of the arrows;

FIG. 7 is a view with certain parts omitted looking approximately from line 7—7 of FIG. 1 in the direction of the arrows; and

FIG. 8 is an elevational view of two of the rolls of the apparatus of FIG. 1 with one of the rolls having a modified structure.

The present invention is susceptible for use in various machines where it is desirable to apply a coating of a fluid material onto a moving surface with an applicator roll or other type of rotating applicator but it is particu-

larly useful to apply dampening fluid to the surface of a printing press plate cylinder.

In a lithographic offset printing press, ink and dampening fluid are applied to the printing plate and in the illustrated press, ink is fed to the printing plate through an inking mechanism which includes form rolls **16, 17, 18, 19** which run in engagement with the surface of the printing plate. A vibrating roll **20** is disposed between the form rolls **16, 17** and runs in engagement therewith while a similar vibrator roll **21** engages and runs in contact with form rolls **18, 19**. A vibrator roll **22** also engages form rolls **17, 18**. The vibrating rolls **20, 21, 22** are conventional vibrator rolls having a hard smooth ink receptive metal surface while the form rolls **16, 17, 18** and **19** have conventional resilient surfaces. The ink is fed to the vibrator rolls **20, 21** from an ink fountain **24** by a duct roll **25** and a plurality of ink transfer rolls shown in the drawing. The train of ink rolls shown for supplying ink to the form rolls is that of a conventional inker and therefore will not be described in detail.

In accordance with the preferred and illustrated embodiment, dampening fluid is applied to the plate on the cylinder **10** by a dampening mechanism which feeds the dampening fluid through the first form roll **16** which is larger than the other form rolls. The dampening mechanism includes roll **28** having a hard hydrophilic, smoothly finished surface, preferably chrome, which rotates in pressure relationship with the first form roll **16**, a resilient surface variable speed roll **30** which runs in pressure relationship with the hard chrome roller **28** and a cooperating metering roll **31** having a resilient surface and rotating in a pan **32** containing the dampening fluid. The metering pan roll **31** picks up dampening fluid from the pan **32**, transfers it to the roll **30**, which in turn transfers the dampening fluid to the chrome transfer roll **28** running in engagement with the first form roll **16** to feed the dampening fluid to the form roll and from the form roll **16** to the plate. To control the amount of dampening fluid being transferred between the pan **32** and the form roll, the roll **30** is driven at a speed which is variable to vary the relative surface speeds of the metering roll **30** and the chrome transfer roll **28**. The variable speed metering roll **30** and the metering pan roll **31** are driven to rotate at the same surface speed. Consequently, the metering pan roll **31** is rotated at the same surface as the metering roll **30** but this surface speed is variable to control the amount of fluid transferred between the roll **30** and the roll **28** which rotates at a fixed surface speed for a given press speed. The rolls **28, 30** and **31** each preferably rotate in an opposite direction to the roll or rolls which it engages, but the rolls **30, 31** may be driven so that the roll **30** rotates in the same direction as the chrome roll **28**.

In the preferred mechanism the chrome transfer roll **28** is positively driven from the plate cylinder and is rotated at the same surface speed as the plate cylinder. The vibrator roll **20** is also positively driven from the press at the same surface speed as the plate cylinder in a conventional manner and the form roll **16** is frictionally driven from the vibrator roll **20**, the chrome transfer roll **28** and the plate cylinder. In the illustrated arrangement, the chrome transfer roll **28** is shown as being driven from a gear **33** which is on the plate cylinder and rotates therewith. The gear **33** drives a gear **34** which drives a shaft **37** through bevel gears **35, 36**. The shaft **37** is connected by bevel gears **38, 39** to drive a shaft **40** which in turn drives a shaft **41** through a clutch **42**. The shaft **41** has a bevel gear **43** thereon which meshes with a bevel gear **44** on the shaft of the transfer roll **28**. The spline connection of the gear **43** allows the transfer roll **28** to be moved into and out of engagement with the form roll **16** while maintaining a drive thereto. The chrome roll is preferably driven at the surface speed of the plate cylinder to frictionally drive the form roll **16** at this speed to thereby prevent any drag on the form roll which may occur when a roll which runs in engagement therewith rotates at a slower surface speed. In mechanisms where the dampening roll running in engagement with the form roll is driven at a slower speed, there is a frictional drag on the form roll which tends to slow the form roll as the gap which is present in conventional plate cylinders passes the form roll. I have found that this may cause a scumming or smudging on the lead edge portion of the printing plate. By providing a dampening mechanism where the roll of the dampening mechanism in engagement with the form roll is positively driven at the surface speed of the plate cylinder, this tendency of the slower speed roll **30** to effectively brake the form roll is overcome or minimized.

The variable speed metering roll **30** is driven by a variable speed motor **45** through a positive drive shown as a chain drive **45***a*. A chain drive **45***b* may also be used to drive the metering roll **31** from the roll **30** to rotate them in a 1 to 1 relationship so that they have the same surface speeds.

In the described mechanism, the chrome transfer roll **28** and the form roll **16** are of the same length but the metering roll **30** is longer than the chrome transfer roll **28** so as to extend beyond the opposite ends thereof.

The pressure relationship between the metering pan roll **31** and the metering roll **30** is adjustable to smoothly meter the flow of dampening fluid between the nip of the rolls to provide an evenly distributed thin film of dampening fluid on the roll **30**. The pan metering roll **31** preferably has shaft portions extending from the opposite ends thereof to be supported in bearing blocks which may be moved toward and away from the metering roll **30** to adjust the pressure relationship between the rolls **30, 31**. Bearing blocks of this type are conventional and well known in the art and a simplified bearing support for the roll **31** is shown in FIG. 5. As shown in FIG. 5, the shaft portion **31***a* extending from one end of the roll **31** is received in a self-centering bearing **46***a* in a bearing block **46** which is supported in an inverted U-shaped recess in a guide block **47** mounted on a support member **48** of the frame F of the press. The open end of the U-shaped recess is closed by a plate **50** and a pressure adjusting bolt **50***a* is threaded through the plate **50** to engage the bearing block **46** and is adjustable to move the roll **31** upwardly into an adjustable pressure relationship with the roll **30**. Preferably, the mounting block **47** is mounted onto the support member **48** by screws **47***a* which are received in elongated slots in the mounting block to allow the mounting block **47** and the bearing block **48** to be shifted laterally, i.e. horizontally, to adjust the axis of the roll **31** to provide a skewed relationship relative to the roll **30**. The mounting block **47** is shown as being adjustable laterally by the operation of a plurality of adjusting screws **51**. Since the metering pan roll **31** is supported at both ends by the same type of support the metering roll **31** can be moved to a skewed position relative to the roll **30** as is best shown in FIG. 7. The bearings **46***a* at each end of the roll **31** pivot in the respective block **46** to accommodate the skewing of the roll.

A skewed position for the metering roll **31** is advantageous to obtain a thin evenly distributed film on the roll **31**. When a pressure relationship is established by applying forces to the shaft portions at the opposite ends of the metering roll **31**, the roll tends to bow outwardly in the center portion of the roll and to allow more dampening fluid to pass the center portion of the roll than the ends of the roll. By skewing the axis of the rolls **30, 31**, an even pressure relationship along the area of contact can be obtained since bowing the roll is required to provide an even contact when the rolls are skewed.

The roll **31** may be a crowned roller as indicated in FIG. 8. In FIG. 8, the roll **31** tapers in an arcuate manner from the central portion thereof to the ends so that when the pressure relationship is established between the rolls **30, 31**, the rolls engage over an area of substantially constant width. Preferably, the area of contact is a narrow strip extending the length of the rolls **30, 31**.

The exact extent of the crown may be determined empirically and varies in accordance with the length of the roll and its strength and in accordance with the materials involved. A crowned roll may be used in combination with skewing or in lieu of skewing.

The resilient roll **30** and the chrome roll **28** also run in pressure relationship and this relationship may be adjustable by the use of movable bearing blocks similar to those on the roll **31**.

As indicated by dotted lines in FIG. 1, the form rolls **17, 18** and **19** are supported for movement to an inker off position in a conventional manner while the form roll **16** is moved from its position against the plate by operation of the dampening mechanism. The dampening mechanism as a whole is supported for movement toward and away from the cylinder to move the chome roll **28** into and out of engagement with the form roll **16**. A roller **55** on a pivoted actuating arm **56** may be swung to the position shown in FIG. 1 to move the dampening mechanism from the position shown in FIG. 2 to establish the pressure relationship between the relative positions of the chrome roll **28** and the form roll **16** shown in FIG. 1. The roller engages an adjustable plate **57** on the dampening mechanism to move the latter against the action of a spring **60**. Stops **61, 62** may be provided to limit the movement of the arm between the inker on and inker off position. In its "on" position, the pivoted arm **56** is in a dead center or locking position slightly over dead center. Adjustment of the plate **57** determines the "on" position of the dampener and the pressure relationship between the rolls **16, 28**.

When the vibrating roll **28** is to be moved out of engagement with the form roll **16**, the arm **56** is rotated to allow the dampening mechanism to be moved away from the impression cylinder by the spring **60**.

In the illustrated embodiment, the form roll **16** is mounted for limited movement about the axis of the vibrator roll **20**. When the dampening mechanism is moved to clear the chrome roll **28** from the form roll **16**, the form roll is moved by a spring **65** against a stop **66** to move the form roll out of engagement with the plate cylinder. When the dampening mechanism is again moved to its operative position, the chrome roll **28** engages the form roll **16** and moves it against the spring **65** to a position against the plate cylinder and against a stop **67** which limits the pressure that the form roll may apply to the plate cylinder and provides a resisting force to the chrome roll **28** to establish a pressure relationship between the chorne roll **28** and the form roll **16**.

It can be seen that with the described construction, the dampening mechanism can be operated when the mechanism is in its retracted position to form films on the rolls of the dampening mechanism and to cause the chrome roll **28** to be operating at press speed when it is moved into engagement with the form roll. It will be noted that the dampening mechanism can be moved to engage the form roll **16** with the chrome roll **28** rotating at the surface speed of the press, prior to the form roll engaging the plate. This enables the form roll **16** and the chrome roll **28** to be rotating at their proper speeds when the form roll **16** engages the plate. By positively driving the chrome roll **28**, the chrome roll **28** will be driven at its proper speed when it is moved into engagement with the form roll **16** and the form roll **16** will be driven from both the vibrating roll **20** and the chrome roll **28**. This will also keep the form roll **16** rotating at a surface speed corresponding to the surface speed of the plate cylinder **10** when the gaps in the cylinder **10** are moving past the form roll **16**.

It will be understood by those skilled in the art that the term hard surface roll as used in this specification includes a roll having an unyielding surface such as is commonly present on vibrator rolls and chrome hydrophilic rolls and is used to distinguish from other rolls commonly used in presses and which have a yieldable, resilient surface such as neoprene or rubber.

While the preferred embodiment and other embodiments of the present invention have been disclosed and described in detail, it is hereby my intention to cover all modifications, adaptations and arrangement of parts which fall within the ability of those skilled in the art and within the spirit of the appended claims.

Having described my invention, I claim:

1. In a lithographic printing press having a printing plate mounted on a rotatable plate cylinder with a gap therein, a dampening mechanism for supplying dampening fluid to an applicator roll running in engagement with a printing plate on the plate cylinder, a supply comprising a reservoir of dampening fluid for said plate, a hydrophilic roll running in rolling contact with said applicator roll, first drive means independent of the surface of said hydrophilic roll for positively driving said hydrophilic roll at the surface speed of said printing plate, means for delivering dampening fluid to said hydrophilic roll and forming an even film thereon comprising a resilient surface roll, first support means supporting said resilient surface roll to roll in engagement with said hydrophilic roll and for adjustment toward and away from said hydrophilic roll, second drive means apart from the surface of said resilient surface roll for driving said resilient surface roll at a surface speed which is adjustable independently of adjusting the speed of said hydrophilic roll to adjust the relative surface speeds of said resilient surface roll and said hydrophilic roll to control the amount of dampening fluid delivered to said hydrophilic roll, and means for delivering dampening fluid to said resilient surface roll and for metering the fluid delivered to form a thin evenly distributed film on said resilient surface roll comprising a pan roll which dips into said reservoir of dampening fluid, and second support means rotatably supporting said pan roll in continuous engagement with said resilient surface roll including means for adjusting the axis of said pan roll toward and away from said resilient surface roll separately from the adjustment of said resilient roll toward and away from said hydrophilic roll.

2. In a lithographic printing press having a printing plate mounted on a rotatable plate cylinder with a gap therein, a dampening mechanism for supplying dampening fluid to an applicator roll in running engagement with the printing plate on the rotating plate cylinder, a supply of dampening fluid, a hydrophilic roll running in rolling contact with said applicator roll, said hydrophilic roll having a hard unyieldable hydrophilic surface, drive means independent of the surface of said hydrophilic roll for positively driving said hydrophilic roll at the surface speed of said printing plate, means for delivering dampening fluid to said hydrophilic roll and forming an even film thereon comprising a resilient surface roll, means supporting said resilient surface roll to run in engagement with said hydrophilic roll with the axes of said hydrophilic roll and said resilient surface roll being spaced generally horizontally from each other, said means supporting said resilient surface roll comprising adjustable means for adjusting the distance between the axes of said hydrophilic roll and said resilient surface roll to adjust the pressure relationship therebetween, a metering pan roll disposed generally vertically below said resilient surface roll, means supporting said pan roll for rotation and running engagement with said resilient surface roll including means for adjusting the axis of said pan roll vertically to adjust the pressure relationship between said pan roll and said resilient surface roll, a pan providing a reservoir of fluid in which the lower portion of said pan roll runs, and means for driving said pan roll and said resilient surface roll at the same speed which is slower than the surface speed of the plate cylinder.

3. In a lithographic printing press, a dampening mechanism as defined in claim 2 wherein said supporting means for said pan roll comprises adjustable bearing supports

for adjusting the axis of said support roll horizontally to skew the roll with respect to the resilient surface roll and vertically to urge the skewed pan roll into uniform pressure engagement with said resilient surface roll for substantially the entire length of the rolls.

4. In a lithographic printing press as defined in claim 2 wherein said pan roll comprises a roll having a diameter which progressively decreases proceeding from the center toward each end to compensate for deflection of said shaft means on the establishment of a pressure relationship between pan roll and said resilient surface roll.

5. In a lithographic printing press, a dampening system for supplying fluid to a form roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means horizontally to skew said pan roll relative to said resilient surface roll and means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and a third roll running in liquid transfer relationship with said resilient surface roll with the axis of said third roll being disposed generally horizontally from the axis of said resilient surface roll, drive means separate from the surface of said third roll for driving said third roll at a fixed speed, motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the speed of said third roll.

6. In a lithographic printing press as defined in claim 5 wherein the press includes means supporting said rolls to move said third roll into and out of engagement with said form roll while running in engagement with each other, said drive means for driving said third roll and said motor means being operable to drive the corresponding rolls when said third roll is clear of said form roll and when in engagement with the latter.

7. In a lithographic printing press, a dampening system for supplying fluid to form a roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and a third roll running in liquid transfer relationship with said resilient surface roll with the axis of said third roll being disposed generally horizontally from the axis of said resilient surface roll, drive means separate from the surface of said third roll for driving said third roll at a fixed speed, motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the speed of said third roll, said pan roll comprising a roll having a diameter which progressively decreases proceeding from the center toward each end to compensate for deflection of said shaft means on the establishment of a pressure relationship between pan roll and said resilient surface roll.

8. In a lithographic printing press, a dampening system for supplying fluid to a form roll running in engagement with the plate cylinder comprising a pan containing a reservoir of dampening fluid, a pan roll having its lower portion running in the reservoir of dampening fluid, a resilient surface roll disposed above the pan roll and running in engagement therewith, said pan roll having shaft means projecting outwardly from each end thereof, bearing means supporting said shaft means including means for adjusting said shaft means horizontally to skew said pan roll relative to said resilient surface roll and means for adjusting said shaft means vertically to adjust the pressure relationship between said resilient surface roll and said pan roll, and motor means connected to one of said pan and resilient rolls separately from the surface thereof to drive said pan and resilient surface rolls at the same surface speed and at a speed slower than the surface speed of said form roll.

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EDGAR S. BURR, *Primary Examiner.*

U.S. Cl. X.R.

101—349; 118—262, 222—30; 235—94; 346—98

United States Patent [19]
Kumpf

[11] 3,768,438
[45] Oct. 30, 1973

[54] MACHINE FOR COATING SHEETS OF PAPER AND THE LIKE WITH LIQUID COATING MATERIALS

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[30] Foreign Application Priority Data
May 19, 1971 Germany .... P 21 24 825.9

[52] U.S. Cl. 118/262
[51] Int. Cl. B05c 1/06
[58] Field of Search .... 118/211, 212, 262, 118/248, 249, 239; 117/111 H, 111

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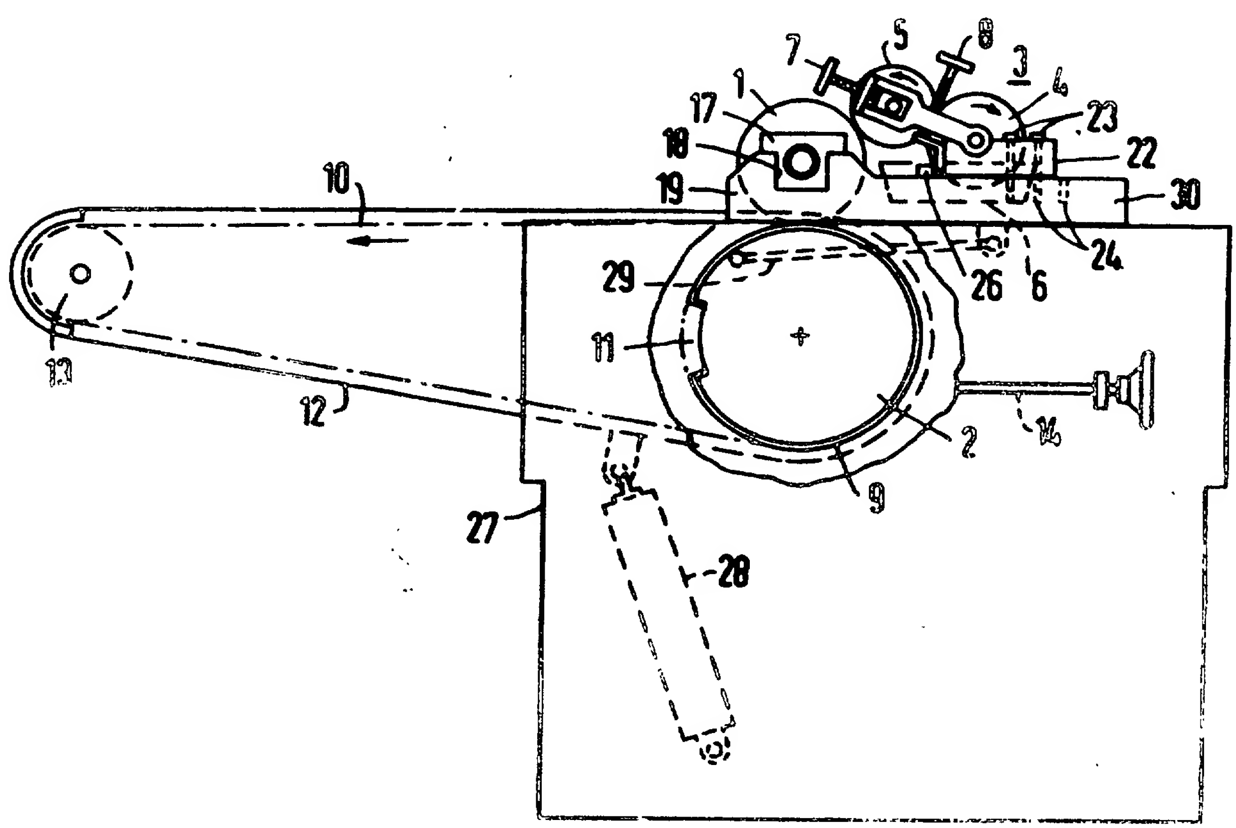
Primary Examiner—Henry S. Jaudon
Attorney—Jacobs & Jacobs

[57] ABSTRACT

A machine for coating sheets of paper and the like with liquid coating materials, in which the sheets are conducted without the application of pressure between a smooth coating roller and a larger diameter format roller, preferably rotating at different peripheral speeds, for coating the entire surfaces of said sheets, a feed roller accepting the coating material from a fountain roller dipping into a supply of coating material and transferring a film of desired thickness to the coating roller. For applying the coating material to predetermined parts of the surfaces of sheets the smooth coating roller together with special chocks mounted in bearing supports is removable from the machine and replaceable by a screen roller provided with screen surfaces corresponding to the surfaces that are to be coated. The screen roller revolves at the same peripheral speed and has the same diameter as the format roller, besides being mounted in taller chocks adapted to its larger diameter, but insertable into the same bearing supports. A doctor blade cooperates with the screen roller attachable to existing fixing means. The format roller is designed to withstand the high roller pressures required for gravure printing.

6 Claims, 3 Drawing Figures



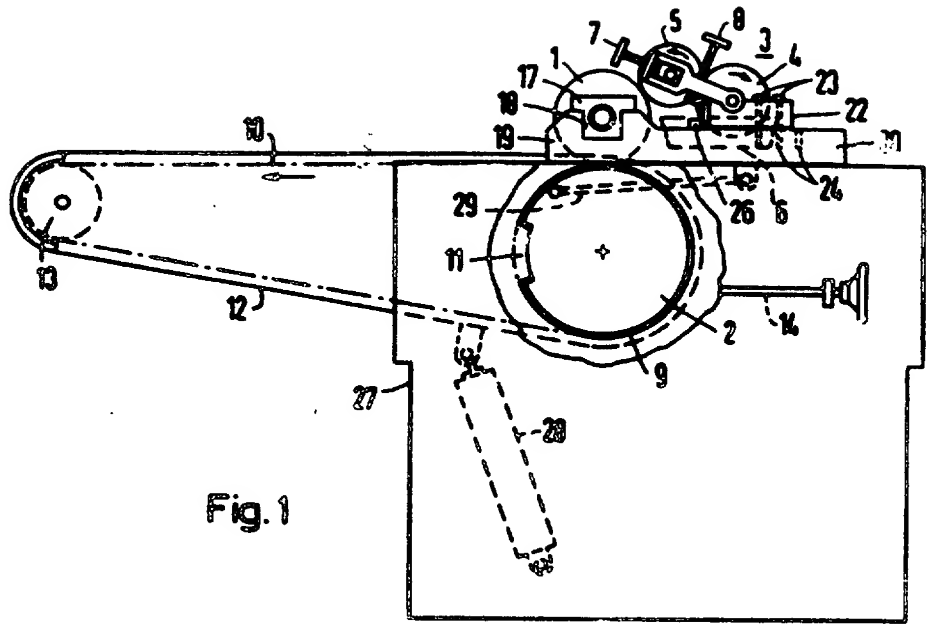

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Fig. 1

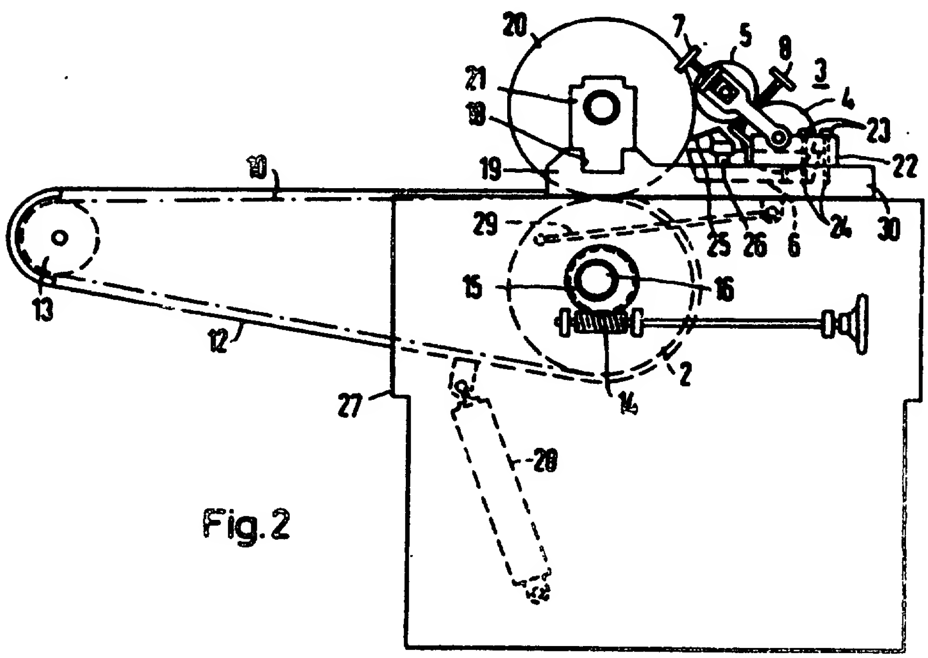
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Fig. 2

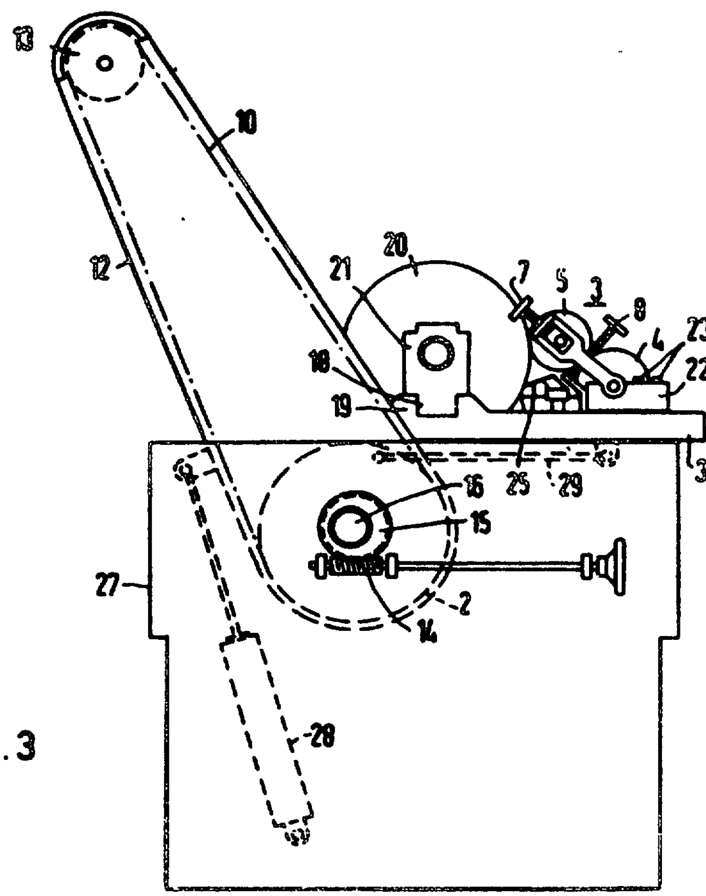

Fig. 3

MACHINE FOR COATING SHEETS OF PAPER AND THE LIKE WITH LIQUID COATING MATERIALS

BACKGROUND OF THE INVENTION

This invention relates to a machine for coating sheets of paper and the like with liquid coating materials, particularly with gloss or colored varnishes or adhesives. Coating the entire faces of sheets of paper usually presents no major difficulty. The coating material can be applied-in the same way as the ink in rotary printing presses — by a system of rubber rollers. Substantially this system comprises a fountain roller which dips into a supply of the coating material and delivers the same through an intermediate transfer or feed roller in the form of a film of the desired thickness to a third roller which functions as a coating roller The latter applies the material to the sheets which are conveyed through the gap between the coating roller and a cooperating counter-roller.

The counter-roller is analogous to a cylinder known in gravure machines as the "format cylinder." It will therefore hereinafter be described as the "format roller," because it likewise carries a rubber blanket underneath which a flat insert is placed of the same format as the sheet that is to be coated. The resultant raised backing for the sheet ensures that only the face of the sheet will be coated but that the remainder of the format roller will remain free of coating material.

However, contrary to gravure machines no pressure is exerted between the coating roller and the counter-roller, since otherwise the film of varnish or the like would be squeezed out. The two rollers are adjusted to leave a gap sufficiently wide to permit the coating material to be applied to the sheet by light contact. A gentle rubbing motion of the coating material is in fact advantageous. Consequently the coating roller and the counter-roller are driven at slightly different peripheral speeds. Analogously, no contact pressure is created between the fountain roller, the feed roller and the coating roller They are likewise placed close enough for the transferred lacquer or like film to have the desired thickness. Since none of the four rollers is required to withstand major stability stresses each may be a lightweight metal cylinder, the coating, feeding and fountain rollers being provided with polished rubber coverings. Moreover, in order to achieve a more uniform distribution of the coating material that is applied to the sheets the circumference of the rubber coating roller is also shorter than the length of the sheet or the circumference of the format roller.

Lacquering and like coating machines of the described kind for coating one complete side of sheets are known in the art. They work satisfactorily and can be produced at low cost so that their employment is economically justified although they are merely auxiliary surface finishing machines that have a low product value compared to that of printing machines.

However, frequently the need arises not only of coating one complete side of paper or like sheets with liquid materials, but also of coating only particular parts of the sheet surface, for instance in the application of coloring or gloss varnishes to paper that is to be used for packing, when certain surfaces are to be kept free of varnish to enable them to accept glue. Moreover, in order to economise in the consumption of say varnish, it is advantageous to coat only those portions of the surface that can later be seen, for instance in folding packages in which large parts of the paper surface are hidden.

In the printing art the inking of part of the surface of sheets is already done in color printing. For this purpose gravure machines are used in which the printing cylinder has a screen corresponding to the surfaces that are to be inked. An excess of ink is applied to these screens and the surplus is removed with a doctor. The ink which remains in the cells of the screen is then transferred to the sheet by the application of considerable pressure. Gravure machines of this kind are large and expensive rotary machines for the production of glossy magazines, books and the like. Their employment for partly coating sheets merely for the purpose of imparting to their usually previously printed surface a greater advertising appeal by the application of a gloss varnish or of providing certain portions with an adhesive would be entirely uneconomical. Machines for performing these latter tasks may cost only a small fraction of the investment cost of a gravure machine if they are to be economically acceptable.

It has also been proposed to solve the problem of coating part surfaces by using plate cylinders in which the surfaces that are to be coated — in the same way as the plates in relief printing — are in relief. However, difficulties arise in the distribution of the coating material, particularly at the edges of such plates.

SUMMARY OF THE INVENTION

The invention seeks to improve the first hereinabove described machine that comprises a rubber roller system for coating the entire side of sheets, the object of the invention being to modify such a machine without major expense so that it can be converted into a machine for coating only predetermined portions of the surfaces of sheets. This makes the provision of a second independent machine for such a purpose unnecessary.

For achieving this object the present invention consists in that for applying a coating material to predetermined parts of the surfaces of sheets the smooth coating roller together with a pair of special chocks mounted in bearing supports is removable from the machine and replacable by a screen roller provided with screen surfaces corresponding to the surfaces that are to be coated, the screen roller revolving at the same peripheral speed and having the same diameter as the format roller, besides being mounted in a pair of taller chocks that are adapted to its larger diameter but are nevertheless insertable into the same bearing supports, a doctor blade cooperating with the screen roller being attachable to existing fixing means and the format roller designed to withstand the high contact pressures required in gravure printing.

Since the circumference of the smooth rubber-covered coating roller for coating the entire face of the sheets must be shorter than the length of the sheets, and also than the circumference of a screen roller, in order to ensure a uniform distribution of the coating material on the face of the sheet, the feed roller must be withdrawn when the machine is re-equipped. For this reason a useful feature of the invention consists in that the feed means for the coating material which in the conventional manner substantially comprise a fountain roller dipping into a supply of coating material, a feed roller accepting the coating material from the fountain roller and transferring the same as a film of the

desired thickness to the coating roller, as well as adjusting means, are mounted as a unit assembly on a common frame portion which can be advanced and retracted a distance that makes allowance for the different diameters of the coating rollers that can be fitted into the machine.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other useful features of the invention will be understood as the following description of embodiments of the invention proceeds, in which reference will be made to the accompanying drawings which are illustrative schematic side elevations of essential parts of the proposed machine.

FIG. 1 is a machine for coating the entire surface of sheets by means of a rubber roller,

FIG. 2 is a machine for coating required parts of the surface of sheets, and

FIG. 3 is the coating machine according to FIG. 2 showing the sheet feed means in raised position.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the coating machine illustrated in FIG. 1 a roller 1 has a polished rubber covering. The purpose of this roller 1 is to apply a coating material to sheets that are conveyed from right to left in FIG. 1 through the gap between the coating roller and a cooperating counter-roller 2. The coating roller 1 obtains the coating material from a feed assembly marked 3 substantially comprising a fountain roller 4, a feed roller 5 and a fountain 6 for the coating material. The fountain roller 4 dips into the fountain and transfers parts of the material which it picks up to the feed roller 5 which transfers a desired thickness of film to the coating roller 1. Adjusting means 7 and 8 are provided to adjust the roller clearances and the required thicknesses of the film of material that is transferred from the fountain roller 4 to the feed roller 5 and from said feed roller to the coating roller 1.

The counter-roller 2 is a format roller. A rubber blanket 9 is wrapped around its circumference and clamped in position. Underneath the rubber blanket 9 is an insert which in size corresponds to the format of the sheet that is to be coated. This insert creates a slightly elevated backing for the sheet. Consequently the coating material will be applied by the coating roller 1 only to the sheet and not to other parts of the format roller 2.

The individual sheets are positioned in relation to the insert by conventional gripper feed means travelling in an endless path at the peripheral speed of the format roller 2. The gripper feed means comprise two chains 10 adjacent the side faces of, and driven by the format roller 2. They are mounted on cross members spaced between the chains 10 at equidistant intervals but not shown in the drawings. These grippers consecutively grip the sheets at the machine entry side, draw them through the gap between the two rollers 1 and 2 whilst being received into a longitudinal recess 11 in the format roller 2, and convey the sheets into proximity with a pair or return wheels 13 mounted some distance away on a cantilever frame 12, where the sheets are released.

There is no contact pressure between the coating roller 1 and the format roller 2, these two rollers being adjusted to the appropriate clearance for the coating to assume the required thickness. For this purpose the format roller 2 has a fine adjustment for elevation, as illustratively indicated in FIGS. 2 and 3 by an eccentric bearing 15 for the format roller shaft 16, and a worm 14 for rotating the eccentric bearing.

The diameter of the coating roller 1 is significantly less than that of the format roller 2. It has been found that the uniformity of the coating applied by the coating roller 1 is disturbed at higher speeds before it makes contact with the sheet if the diameter of the roller exceeds a given size. Coating roller 1 and format roller 2 also have slightly differing peripheral speeds to generate a gentle rubbing action of the coating material.

For changing the machine over from the described process of coating the entire surface of the sheets, as shown in FIG. 1, to coating only one or more parts of the surface of the sheets, the smooth coating roller 1 is removed and replaced by a screen roller of the same diameter, and driven at the same speed as the format roller 2. In order to facilitate dismantling and assembling the rollers the coating roller 1 is mounted in special chocks 17 which are received into ways 18 in bearing supports 19 which they are bolted to.

Referring to FIG. 2 in which the same reference numerals as in FIG. 1 identify like parts, the screen roller 20 which has replaced the smooth coating roller 1 (FIG. 1) is likewise mounted in suitable chocks 21. Owing to the larger diameter of the screen roller 20 these chocks 17 are higher than those shown in FIG. 1, but they fit into the same ways 18 of the bearing supports 19. The same holes can also be used for bolting the chocks in position.

The position of the feed roller 5 must be adjusted to the larger diameter of the screen roller 20. In order to simplify this operation it is useful to combine the entire feed assembly 3, substantially comprising the fountain roller 4, the feed roller 5 including the adjusting means 7 and 8, and the fountain 6 itself, in a single unit assembly. This may be mounted in a special portion 22 of the frame attached by screws 23 to its base. After undoing these screws 23 the entire multi-component feed assembly 3 can be moved back a suitable distance determined by tapped holes 24 for the reception of the screws 23.

The screen roller 20 is provided, directly on its surface or on a metal plate thereon, with a screen similar to that used in photogravure, the screen covering those parts which correspond to the parts on the sheets that are to be coated. In order to remove from the regions outside the cells of the screen the unwanted coating material which has been applied to the entire surface of the screen roller 20, a doctor 25 is used which is mounted, together with its holder, on fixing means 26. In the simplest case the latter may merely be tapped holes for the reception of fixing screws.

Whereas in a machine equipped with a rubber coating roller for coating the entire surface of the sheets the format roller is not submitted to contact pressure and may therefore be of light-weight construction, it is called upon, in the embodiment of the machihe according to FIGS. 2 and 3, to press the sheet against the screen roller with a considerable amount of pressure, as in gravure printing. The format roller 2 is therefore designed for withstanding such high pressures and remains in the machine even when the entire face of the sheet is to be coated and a rubber coating roller 1 (FIG. 1) is used.

Consequently, if it is desired to re-equip a machine using a rubber coating roller for coating the entire

sheet surface for the purpose of coating only parts of the sheet surface, it is in practice only necessary, apart from one or two minor changes to be made in the machine itself, to provide an additional screen roller and a doctor, i.e., an expense which is in no way comparable to the cost of a second machine.

The change-over itself is likewise not very difficult and can be accomplished within a short time. The work can be significantly facilitated if the cantilever frame 12 carrying the pair of return wheels 13 can be hingeably raised. For this purpose the cantilever frame 12 which substantially consists of two sides that are connected together at suitable points may be hinged coaxially with the format roller shaft 16, either on this shaft itself or in a machine frame 27 in alignment therewith, the cantilever frame resting on supports provided on the machine frame 27 when in the working position shown in FIGS. 1 and 2. Lifting means, such as hydraulic ram cylinders 28 attached to each cantilever half, may conveniently be provided for raising the frame 12. To avoid the coating roller 20 or 1 (FIG. 1) being in the way, this roller may be retractable. For this purpose the bearing supports 19 may have extensions which carry the frame portion 22 supporting the coating roller assembly, the extensions forming a slide 30 movable in special ways in the machine frame 27. Two coupling rods 29 may be linked at one end to side members of the cantilever frame 12 and at the other end to the slide 30 in such a manner that when the cantilever frame 12 is raised the slide 30 will be automatically moved out of the way together with the assembly which it supports. When the cantilever frame 12 is raised the delivery side of the machine is fully accessible for the insertion and adjustment of the inserts on the format roller 2, for cleaning the rollers, exchanging the coating rollers 1 or 20 for inspecting, repairing and so forth.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The embodiments are therefore to be considered in all respects as illustrative and not restrictive.

What is claimed is:

1. A coating machine comprising (a) a frame, (b) a format roller rotatably mounted on the frame, (c) a pair of supports mounted on the frame parallel to the axis of the format rollers and operable to receive chock elements, (d) a first roller and chock assembly comprising (i) a pair of chocks mountable in the supports and (ii) a coating roller rotatably mounted in its associated chocks and being of a diameter smaller than that of the format roller, the chocks of said first assembly being of a height sufficient to dispose said coating roller and said format roller in parallel coating aligment without contact pressure, and (e) a second roller and chock assembly interchangeable with the first roller and chock assembly and comprising (i) a pair of chocks mountable in the support and (ii) a screening roller rotatably mounted in its associated chocks and being of the same diameter as said format roller, the chocks of said second assembly being of a height sufficient to provide contact pressure between said format roller and said screen roller.

2. A coating machine as defined in claim 1 including (a) coating material feeding means detachably mounted on said frame, said means comprising (i) a fountain roller operable to dip into a coating material reservoir, (ii) a second feed roller accepting coating material from said fountain roller and transferring the same to a third roller, said third roller being either said coating roller or said screen roller, (iii) means for adjusting the distance between the fountain roller and feeder roller and (iv) means for adjusting the distance between the feeder roller and said third roller, and (b) means for moving said coating material feeding means from a first position on the frame when said first roller and chock assembly is disposed in said supports to a second position when said second roller and chock assembly is disposed in said supports.

3. A coating machine as defined in claim 2 wherein said feeding means includes a doctor disposed to engage the screening roller when said second roller and chock assembly is disposed in said supports but not the coating roller when said first roller and chock assembly is disposed in said supports.

4. A coating machine as defined in claim 1, including stock feeding means, said feeding means comprising two endless chains with grippers mounted thereinbetween, said chains running at one end over chain wheels disposed coaxially with the format roller and at the other end over chain wheels disposed away from the delivery side of the rollers, said chain wheels being mounted on a cantilever frame which is hingeably raisable coaxially with the axis of the format roller.

5. A coating machine as defined in claim 4, wherein the supports and feeding means are slideably mounted on the frame.

6. A coating machine as defined in claim 5, wherein the cantilever frame is coupled to the feeding means and supports so that raising the cantilever frame about its hinge displaces the support and feeding means from their working position and lowering the cantilever frame returns the support and feeding means to their working position.

* * * * *

26

United States Patent [19]

Egnaczak

[11] **3,800,743**

[45] **Apr. 2, 1974**

[54] **MATERIALS APPLICATION APPARATUS**

[75] Inventor: **Raymond K. Egnaczak**, Williamson, N.Y.

[73] Assignee: **Xerox Corporation**, Rochester, N.Y.

[22] Filed: **Mar. 1, 1971**

[21] Appl. No.: **119,914**

Related U.S. Application Data

[62] Division of Ser. No. 876,646, Nov. 14, 1969, Pat. No. 3,609,029.

[52] **U.S. Cl.**......... **118/259,** 117/17.5, 118/DIG. 23, 118/241, 118/637

[51] **Int. Cl.** **B05c 1/06,** B05c 1/08

[58] **Field of Search**............ 118/DIG. 23, 637, 104, 118/203, 258, 259, 241, 242, 260, 268, 266, 50; 117/17.5, 37 LE

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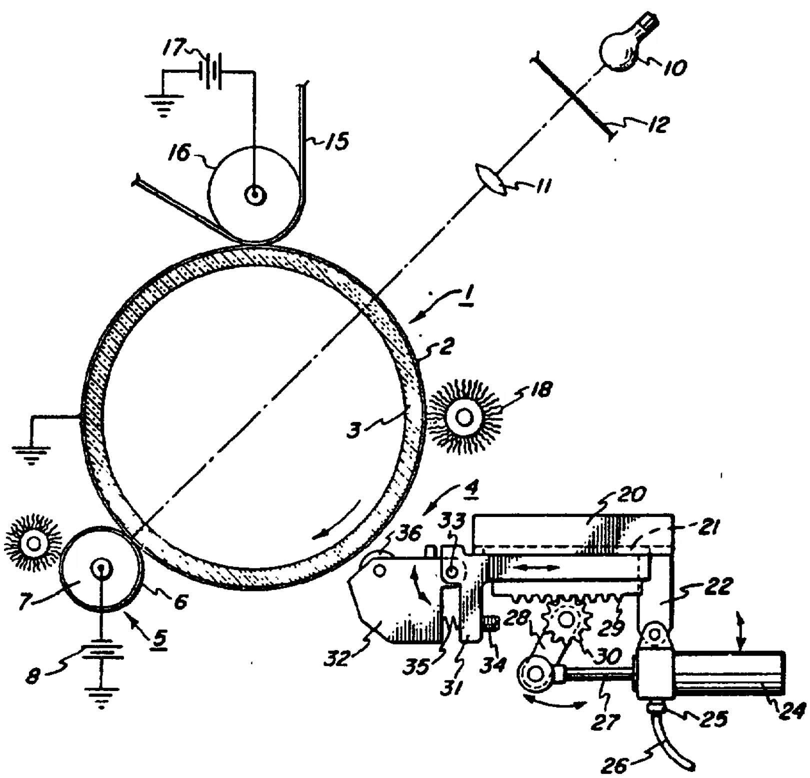
Primary Examiner—Mervin Stein
Assistant Examiner—Leo Millstein

[57] **ABSTRACT**

Apparatus for coating materials onto a surface comprising a housing pivotally connected to a carriage, a chamber and applicator within the housing. The pressure of the applicator against the surface to be coated is adjusted by varying the pivot of the housing containing the applicator relative to the carriage. The entire apparatus is advanced automatically into and out of contact with the surface to be coated. An alternative embodiment with an extruder applicator is also disclosed.

9 Claims, 4 Drawing Figures



MATERIALS APPLICATION APPARATUS

This is a division of application Ser. No. 876,646, filed in the United States, Nov. 14, 1969, now U.S. Pat. No. 3,609,029.

This invention relates to coating systems and in particular to a fluid extruder system.

Systems exist that require working with layers of fluids, especially viscous liquids, that must be uniformly applied to a surface for working on the surface. One such system improved by a uniform coating technique and by the invention herein is the photoelectrophoretic imaging process. A detailed description of this process is given in U.S. Pat. Nos. 3,384,565, 3,384,566 and 3,383,993. These patents disclose how to produce a visual image at one or both of two electrodes between which a photoelectrophoretic particle suspension is placed. The particle suspension is comprised of photosensitive particles suspended within an insulating liquid carrier. The particles appear to undergo a net change in charge polarity or a polarity alteration by interaction with one of the electrodes upon exposure to activating electromagnetic radiation. The theory of operation is that the particles have a net charge when suspended in the liquid carrier and are attracted to the electrodes under the influence of an electrical field placed between them. Mixtures of two or more differently colored particles can secure various colors of images. The particles will migrate from one of the electrodes under the influence of an electric field when struck with energy of a wavelength within the spectral response of the colored particles.

Since the disclosure of the basic processes, continuous imaging machines have been disclosed, for example, in U.S. Pat. No. 3,427,242. It becomes important to be able to supply uniformly thin layers of the imaging suspension to one of the electrodes in such automated devices in order to form the best possible images from the machine.

It is also helpful in many instances to stress the suspension with a shear stress. This apparently improves the imaging qualities of the suspension.

Therefore, it is an object of this invention to improve fluid coating means. Another object of this invention is to improve means for uniformly coating liquids on a surface. Still another object of this invention is to extrude fluids onto a surface. Yet another object of this invention is to pre-stress fluids for application to a surface.

The invention herein is described and illustrated in a specific embodiment having specific components listed for carrying out the functions of the apparatus. Nevertheless, the invention need not be thought of as being confined to such a specific showing and should be construed broadly within the scope of the claims. Any and all equivalent structures known to those skilled in the art can be substituted for specific apparatus disclosed as long as the substituted apparatus achieves a similar function. It may be that other processes or apparatus will be invented having similar needs to those fulfilled by the apparatus described and claimed herein and it is the intention herein to describe an intention for use in apparatus other than the embodiment shown.

These and other objects of this invention are accomplished by employing a system for forcing fluids to a moving surface through an extruder mechanism adapted to supply a uniformly thin coating of the fluid

on the surface moving thereby. A smoothing means and a pulsed fluid manifold ensure the uniformity of the thin layer of fluid on the coated surface. These and other objects and advantages of this invention will become apparent to those skilled in the art after reading the description in conjunction with the accompanying drawings wherein:

FIG. 1 schematically represents an embodiment of this invention in conjunction with a photoelectrophoretic imaging system;

FIG. 2 is a close-up of the application member with portions broken away to show internal structure;

FIG. 3 is a fluid supply system shown, for example, for use in conjunction with the apparatus of FIG. 4; and

FIG. 4 shows an alternative embodiment of apparatus according to this invention.

There are certain terms of art used in conjunction with the photoelectrophoretic imaging process that should be defined. The "injecting electrode" is so named because it is thought to inject electrical charges into activated photosensitive particles during imaging. The term "photosensitive" for the purposes of this disclosure refers to the property of a particle which, once attracted to the injecting electrode, will alter its polarity and migrate away from the electrode under the influence of an applied electric field when exposed to activating electromagnetic radiation. The term "suspension" may be defined as a system having solid particles dispersed in a solid, liquid or gas. Nevertheless, the suspension used in the disclosure herein is of the general type having a solid suspended in a liquid carrier. The term "imaging electrode" is used to describe that electrode which interacts with the injecting electrode through the suspension and which once contacted by activated photosensitive particles will not inject sufficient charge into them to cause them to migrate from the imaging electrode surface. The imaging electrode is covered with a dielectric surface composed of a material having a volume resistivity preferably in the order of 10^7 or greater ohm-cm and a conductive member which is preferably a resilient material such as a conductive rubber used to give flexibility to the imaging electrode.

For photoelectrophoretic imaging to occur it is thought that these steps, (not necessarily listed in the sequence that they occur) take place: (1) migration of the particles toward the injecting electrode due to the influence of an electric field, (2) the generation of charge carriers within the particles when struck by activating radiation within their spectral response curve, (3) particle deposition on or near the injecting electrode surface, (4) phenomena associated with the forming of an electrical junction between the particles and the injecting electrode, (5) particle charge exchange with the injecting electrode, (6) electrophoretic migration toward the imaging electrode, (7) particle deposition on the imaging electrode. This leaves an optically positive image on the injecting electrode.

The schematic representation of FIG. 1 shows a photoelectrophoretic imaging apparatus having an injecting electrode 1 with a coating of a transparent conductive material 2 such as tin oxide over a transparent glass member 3. Such a combination is commercially available under the name NESA glass from Pittsburgh Plate Glass Company of Pittsburgh, Pa. However, other electrically conductive transparent coatings over transpar-

ent substrates are suitable for use herein. Imaging suspension is applied to the surface of the injecting electrode by the extruder mechanism 4 where it is carried because of the motion of the injecting electrode to the imaging area between the injecting electrode and the imaging electrode 5.

The imaging electrode 5 has a surface 6 composed of a dielectric material sleeve and a conductive substrate 7 which is preferably a resilient material such as an electrically conductive rubber. The imaging electrode prevents sufficient charge injection into the particles to cause them to migrate from its surface. The imaging electrode is connected to a potential source 8 while the injecting electrode is shown as electrically grounded to give the necessary field affect at the imaging area between the two electrodes. An exposure mechanism including an illumination means 10 and a lens 11 presents a flowing image of the object 12 at the image area which coincides with the optical image plane. The image is moving at the imaging area at the same rate as are the moving surfaces of the injecting and imaging electrodes. The image thus formed at the imaging area is carried by the injecting electrode to the transfer station where it is transferred to a support sheet 15. The transfer roller 16 is coupled to an electrical source 17 providing a field with the injecting electrode opposite in sign from that at the imaging area. A cleaning brush 18 removes residual particles from the surface of the injecting electrode so that the imaging cycle may be completed with other images being formed.

The extruder mechanism 4 is mounted on a brace 20 which has rails 21 therein. A stationary bracket 22 mounts an air cylinder 24 having an air inlet 25 and an air intake hose 26. The piston 27 of the cylinder, through the crank arm 28, moves a rack 29 and pinion 30 to engage and disengage the extruder in suspension application interface with the injecting electrode surface 2. The rack moves the extruder mounting 31 in the rails 21 of the brace 20.

The interfacing portion 32 of the extruder is pivoted about a pin 33 and is preset with an interface pressure adjusting screw 34 and an adjusting spring 35. The interfacing member shown in FIG. 1 is a smoothing rod 36 which can be grooved, wound wire, knurled, or smooth surfaced to present a uniformly thin layer of suspension on the injecting electrode surface.

FIG. 2 is a closeup of the interfacing portion 32 of the extruder with the side wall removed so that internal parts are seen. The suspension is pulsed in through the inlet tube 40 into a chamber 42 enclosed by the smoothing rod 36, a frame member 43, a coater blade 44 and a scraper blade 46. The smoothing rod 36 is driven with outboard oversize drive wheels pressed against the ends of the injecting electrode cylinder so that it moves when the wheels are in contact with the cylinder. A coater blade 44 limits the amount of suspension traveling around the periphery of the smoothing rod 36 for contact with the injecting electrode surface 2. The scraper blade 46 prevents used imaging suspension from contaminating the suspension held in the chamber 42 while preventing the suspension within the chamber 42 from leaking out of that chamber. The chamber 48 of the interfacing portion 32 of the extruder is a vacuum chamber for removing suspension materials within its housing walls 50. The materials are carried through the outlet 52 for removal from the vicinity of the injecting electrode and the imaging system. The drive wheels are larger in diameter than is the smoothing rod 36. The difference in diameter determines the clearance between the smoothing rod 36 and the surface 2. The thickness of the coated fluid on the surface is more or less equal to the clearance.

FIG. 3 demonstrates the gas and suspension supply system for the extruder. A few definitions of terms will be helpful at this point to more fully understand the use intended herein. A "negative pressure source" refers to a cylinder or other means which is partially evacuated of gases to lower its internal pressure below atmospheric pressure. Similarly a "positive pressure source" refers to a cylinder or other means containing a compressed gas to create an internal pressure greater than atmospheric pressure. The term "vacuum" refers to a negative pressure but not necessarily to an absolute void. The term "fluid" encompasses both gases and liquids The gases referred to are those commonly found in the atmosphere and identified generally as air.

The imaging suspension holding tank 54 maintains a quantity of imaging suspension 56 in its hermetically sealed chamber. Gases from the positive pressure gas source 58 enter the tank 54 through a gas regulator 59 which sets the positive pressure in the suspension holding tank 54. The mechanism 60 maintains the seals in the closure of the tank to prevent fluids escaping therefrom.

To reach the extruder 4, the suspension must pass through a valve 62 operated by a cylinder 64 and a crank arm linkage combination 66. The valve has a passage way 68 therein which, when turned in the proper direction, permits a pulsed shot of suspension to pass through the conduit 70 to the distribution manifold 72 for passage through the individual ink flow metering valves 73–76. The valve 62 is opened and closed by the action of the solenoid SOL-1 and the 4-way valve 78 having a gas intake conduit 79 and an exhaust conduit 80. The solenoid and 4-way valve operate to move the piston 82 of the cylinder 64 to rotate the valve 62 thus opening and closing the passageway. This connects the suspension 56 from the tank 54 to the conduit 70 allowing for pulsed shots of suspension through the distribution manifold 72 and conduits 77a-80a to the extruder 4.

An alternative embodiment for an extruder mechanism is shown in FIG. 4. An extruder housing 84 with a suspension intake connection 86 has an internal chamber 87 for accumulating suspension. The suspension is forced through the extruder at the exit aperture 88 for application to the surface 2 of the injecting electrode 1. To ensure that a smooth uniform layer of suspension moves to the imaging area, a smoothing rod 89 is placed downstream from the extruder along the path of movement of the surface. The smoothing rod is journaled through the support bracket 90 of a shaft 91 to freely rotate while being driven by the injecting electrode 1.

While this invention has been described with reference to the structures disclosed herein and while certain theories have been expressed, it is not confined to the details set forth; and this application is intended to cover such modifications or changes as may come within the purposes of the improvements and scope of the following claims.

What is claimed is:

1. A coating apparatus comprising:

a. a carriage;

b. a housing pivotally connected to said carriage;
c. an applicator mounted in said housing and adapted to be brought into contact with a surface to be coated;
d. a chamber defined by a portion of said housing, said chamber for maintaining a reservoir of coating material to be applied by said applicator;
e. pressure adjusting means to vary the contact pressure of said applicator against the surface to be coated by varying the pivot of said housing and said applicator relative to said carriage, wherein said pressure adjusting means is operatively connected between said carriage and said housing; and
f. drive means for advancing said carriage, said housing and said applicator into and out of contact with the surface to be coated.

2. Coating apparatus according to claim 1 wherein said applicator is a roller mounted for rotation in said housing and including in combination

a. a second chamber defined by a portion of said housing, said chamber for collecting coating material from the surface of said applicator roller after said roller has contacted the surface to be coated; and
b. removing means for removing uncoated material from said applicator roller portions after said portions have contacted the surface to be coated and to remove such material to said second chamber prior to the portions rotating into the chamber for maintaining a reservoir of coating material to be applied by said applicator.

3. The coating apparatus according to claim 2 wherein said removing means comprises a scraper blade which also separates said chamber and said second chamber.

4. Coating apparatus according to claim 3 wherein said second chamber is a vacuum chamber and further including in combination coating material removal means for removing coating material from said second chamber which has been scraped from said roller applicator.

5. Coating apparatus according to claim 3 including in combination supply means for supplying coating material under pressure to said chamber.

6. Coating apparatus according to claim 5 including in combination means for supplying metered amounts of coating material to said chamber comprising a pulsing valve means to enable pulsed shots of coating material to pass to said chamber.

7. Coating apparatus according to claim 3 further including in combination a smoothing means connected to said housing to form a uniform layer of coating material on the surface of said applicator roller after it has come in contact with coating material from said chamber but before it contacts the surface to be coated.

8. An extruder apparatus for applying coating material to a surface comprising:

a. a carriage;
b. an extruder housing mounted to said carriage, said housing defining an exit aperture;
c. a chamber defined internally by said housing, said chamber for maintaining a reservoir of coating material to be applied through the exit aperture;
d. supply means for supplying coating material to said chamber;
e. valve control means to enable pulsed shots of coating material to be supplied to said chamber and then through the exit aperture to a surface to be coated;
f. a smoothing rod mounted on said extruder housing downstream from said exit aperture along the path of movement of the surface to smooth the coating materials coated on the surface to be coated through the exit aperture; and
g. drive means for advancing said carriage, said extruder housing and said smoothing rod to and from the surface to be coated, so that said smoothing rod could be brought into and out of contact with said surface.

9. A coating apparatus comprising:

a. a carriage;
b. a housing pivotally connected to said carriage;
c. an applicator roller mounted for rotation in said housing and adapted to be brought into contact with a surface to be coated;
d. a chamber defined by a portion of said housing, said chamber for maintaining a reservoir of coating material to be applied by said applicator roller;
e. a second chamber defined by a portion of said housing, said chamber for collecting coating material from the surface of said applicator roller after said roller has contacted the surface to be coated;
f. removing means for removing uncoated material from said applicator roller portions after said portions have contacted the surface to be coated and to remove such material to said second chamber prior to the portions rotating into the chamber for maintaining a reservoir of coating material to be applied by said applicator, said removing means comprising a scraper blade which also separates said chamber and said second chamber;
g. pressure adjusting means to vary the contact pressure of said applicator roller against the surface to be coated by varying the pivot of said housing and said applicator roller relative to said carriage;
h. supply means for supplying coating material under pressure to said chamber, said supply means including means for supplying metered amounts of coating material to said chamber comprising a pulsing valve means to enable pulsed shots of coating material to pass to said chamber; and
i. drive means for advancing said carriage, said housing and said applicator roller into and out of contact with the surface to be coated, said drive means for advancing said carriage comprising:
   i. a stationary brace slideably mounting said carriage,
   ii. a rack mounted on said carriage,
   iii. a rod,
   iv. rod drive means for advancing said rod,
   v. a pinion engaging said rack, and
   vi. a crank arm connecting said rod and said pinion to translate the movement of said rod to said carriage.

* * * * *

United States Patent [19]

Knodel et al.

[11] **3,916,824**

[45] **Nov. 4, 1975**

[54] **DEVICE FOR COATING STRIP MATERIAL IN CONTINUOUS OPERATION**

[75] Inventors: **Peter Knodel**, Leonberg; **Gerhard Mayer**, Leinfelden; **Horst Munsterer**; **Reinhold Wagner**, both of Neuss, all of Germany

[73] Assignee: **Aluminium Norf GmbH**, Neuss, Germany

[22] Filed: **Aug. 23, 1974**

[21] Appl. No.: **500,073**

[30] **Foreign Application Priority Data**

Aug. 29, 1973 Germany 2343431

[52] **U.S. Cl.** **118/224**; 118/65

[51] **Int. Cl.²** **B05C 1/00**

[58] **Field of Search** 118/61, 68, 223, 224, 246, 118/249, 258, 259

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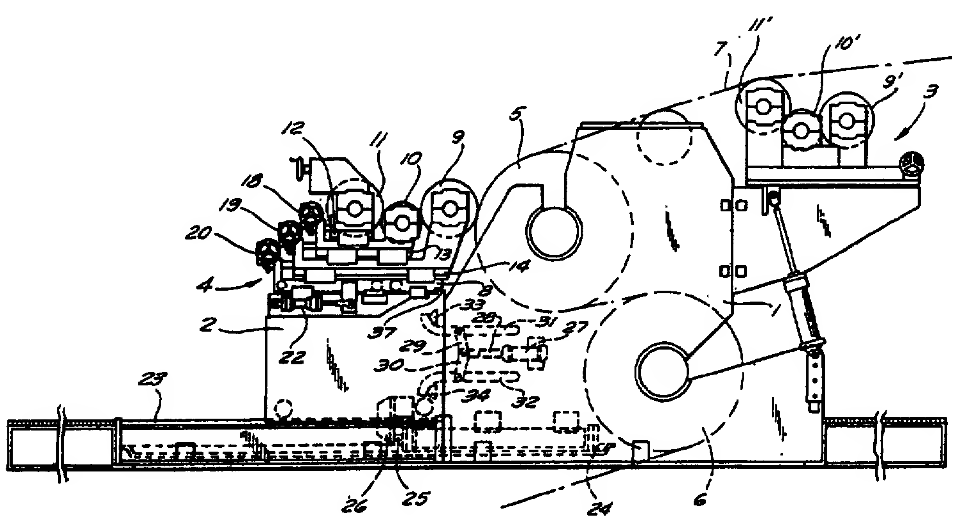
Primary Examiner—Mervin Stein
Assistant Examiner—Steven Hawkins
Attorney, Agent, or Firm—Hane, Baxley & Spiecens

[57] **ABSTRACT**

There is disclosed a coating device for coating bands or ribbons with a coating material in continuous operation. The coating device comprises a main frame which mounts one or two deflector rollers for guiding and conveying the band or ribbon material to be coated. Coating is effected by a coating assembly which includes a fountain roll, a metering roll and an applicator roll which are disposed in axially parallel relationship and are adjustable relative one to another and relative to the band or ribbon to be coated as it is guided over one of the deflector rollers. The coating assembly is mounted on an auxiliary frame which is displaceable in the direction normal to the deflector roller over which the ribbon or band is guided. The auxiliary frame, in turn, is displaceable relative to the main frame for the purpose of making the rolls in the coating assembly conveniently accessible for cleaning or other servicing. There is further disclosed an installation including one or more coating devices in superimposition, each enclosed by an enclosure and drying and burning assemblies for purifying obnoxious or toxic pollutants entrained in the air passed through the enclosures of the coating devices before the air is discharged in the atmosphere.

11 Claims, 3 Drawing Figures



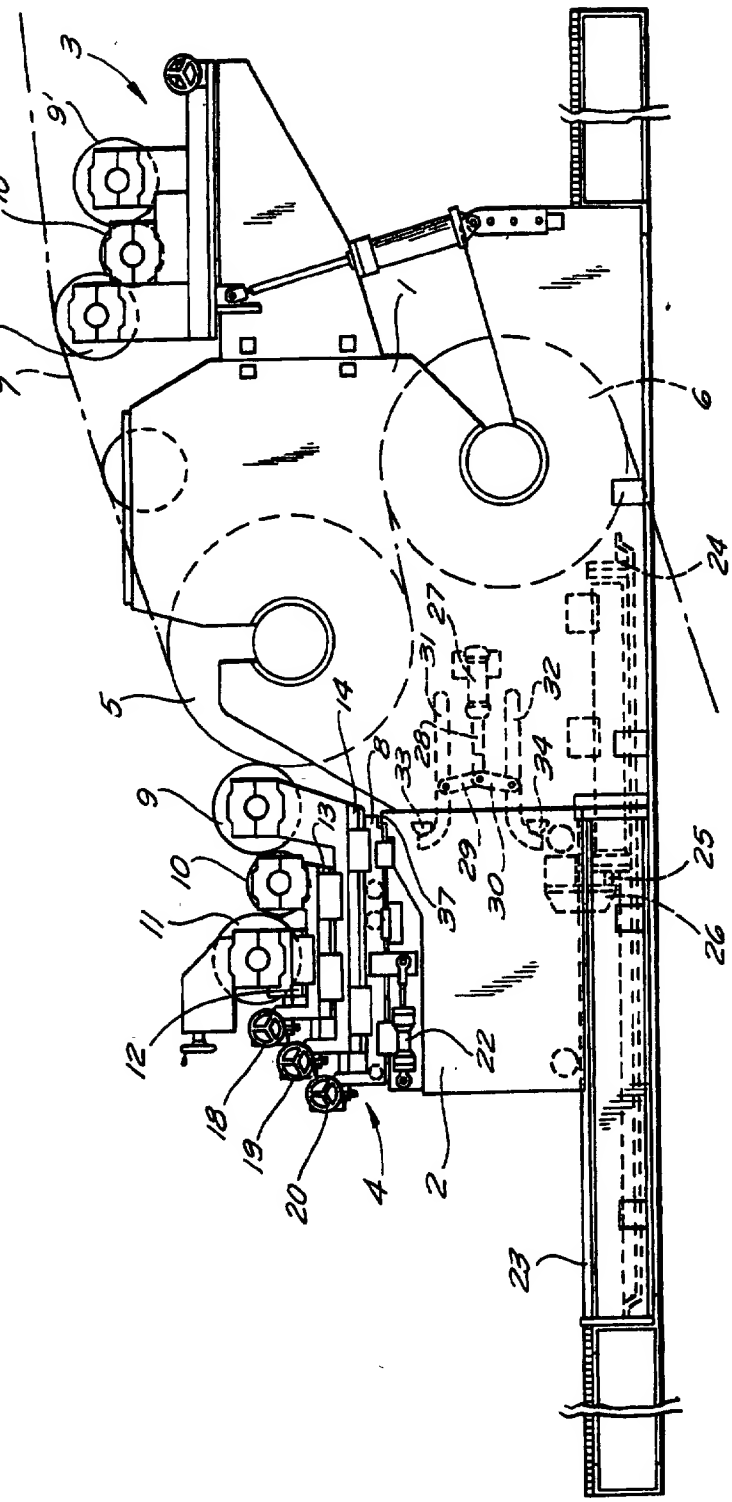

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FIG. 1

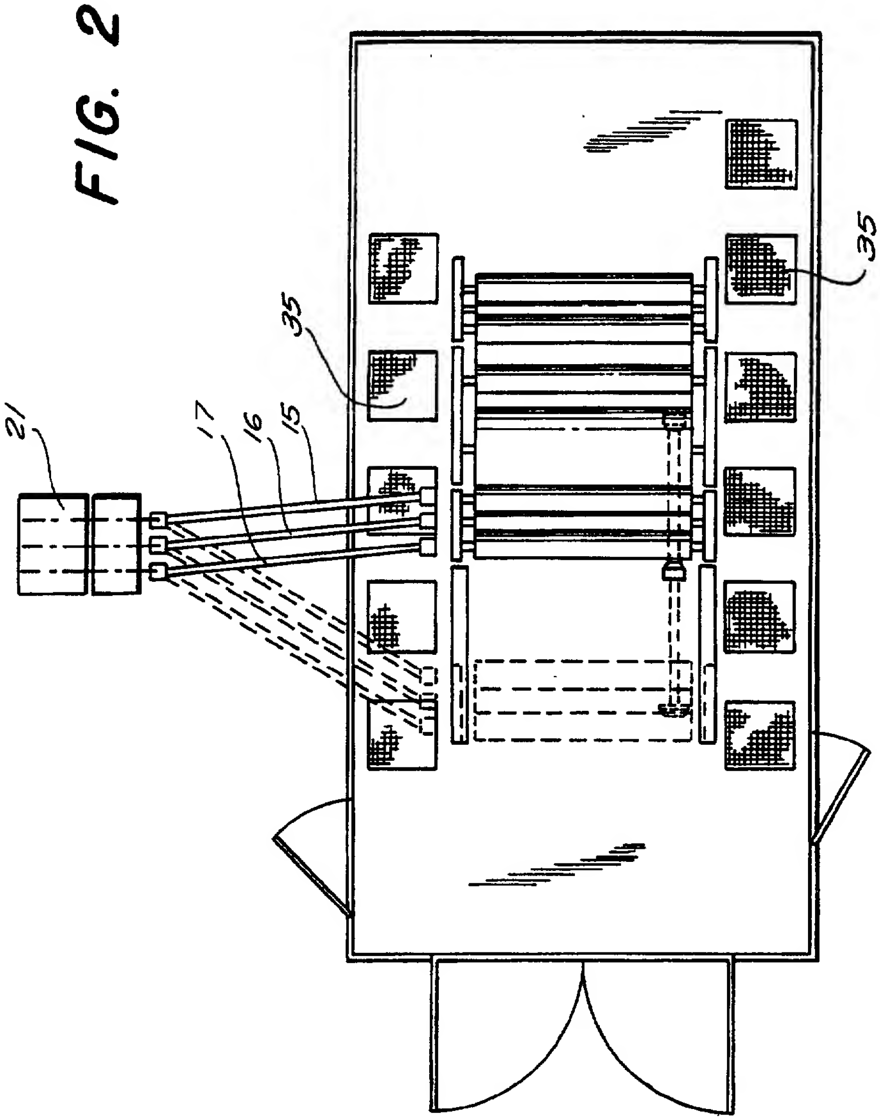

FIG. 2

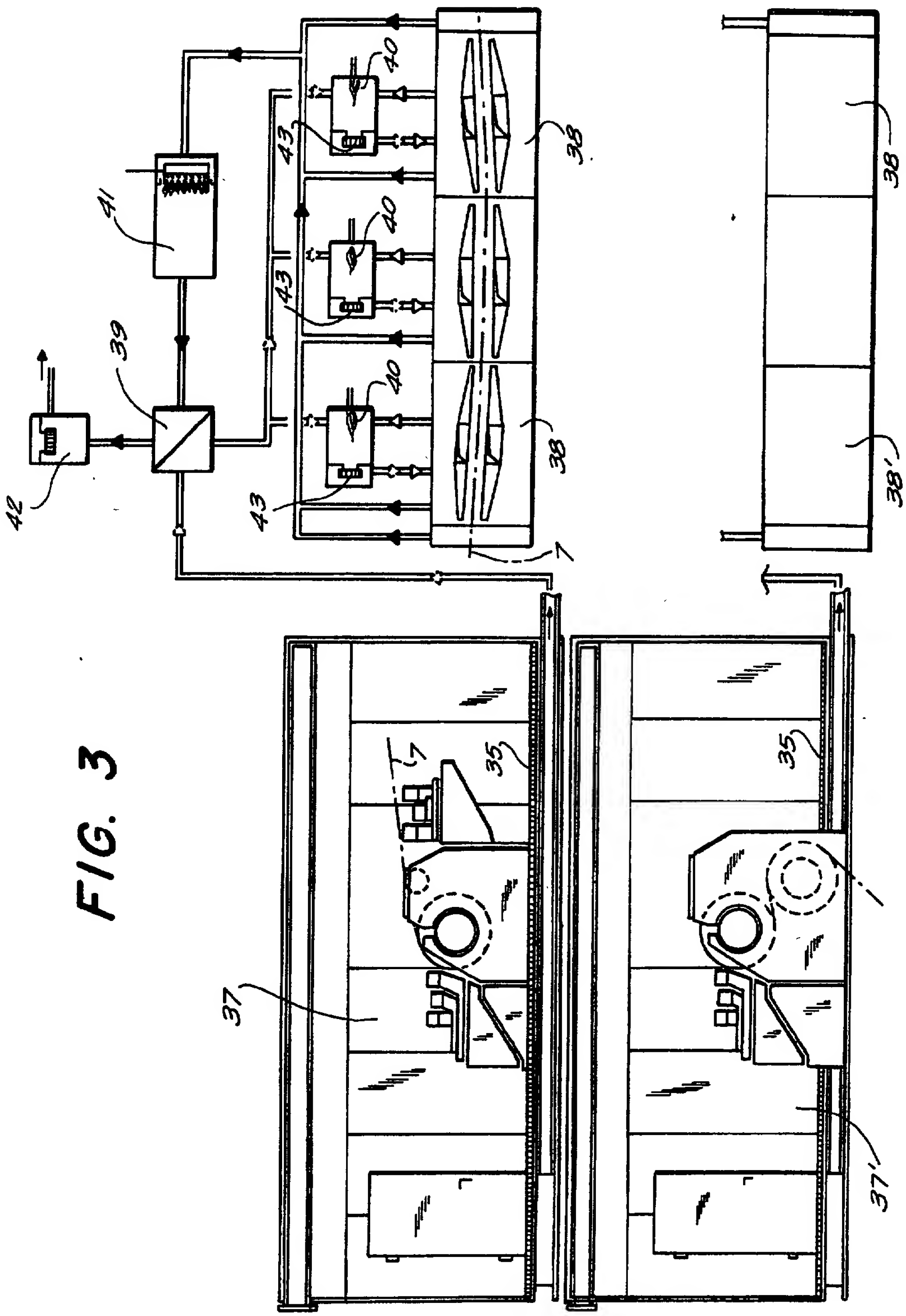

FIG. 3

DEVICE FOR COATING STRIP MATERIAL IN CONTINUOUS OPERATION

The invention relates to a coating device for coating material in ribbon or band form in continuous operation and also to an installation which includes such coating devices and purifying means for removing pollutants entrained in the air used for accelerating drying of the coating material after application thereof before the air is discharged into the atmosphere.

BACKGROUND

There are known coating devices of the general kind above-referred to which include one deflector roller or an upper and a lower deflector roller for guiding and conveying the band or ribbon material to be coated in continuous operation. In many instances the quality specifications with respect to the uniformity of the coating on the band or ribbon material is much greater for one side of the material than for the other side. In that case, the coating device for producing the high quality coating comprises a fountain roll for taking-up coating from a source of supply, a metering roll and an applicator roll. Such coating device for producing the high quality coating is mounted on a frame structure so that its position can be adjusted relative to the respective deflector roller.

Installations for coating band or ribbon material frequently comprise two coating devices to permit rapid changing from one type of coating material to another; for instance, it may be desired to change the color or the coating material. If two or even more coating devices are provided, the devices are generally arranged in superimposition and mounted on a common frame structure detachable therefrom. With an installation of this type, the band or ribbon side to be coated with the high quality coating being generally the upwardly facing sides, it becomes necessary to effect a thorough cleaning of the rolls of each coating device before a change in color or coating material can be effected. As is evident, if the cleaning is not thoroughly made any residues of the previously used material will cause irregularities in the coating made after the cleaning of the coating device.

The need for such thorough cleaning of the coating devices is well understood in the art and to make such cleaning possible it is known to arrange the coating devices in the installation so that each of the coating devices can be laterally withdrawn to assure that the coating devices are accessible for cleaning. The disadvantage of such laterally displacement as is now known is that considerable space is required for the coating device itself and such high space demand, in turn, greatly enlarges the total space required for the complete coating installation, i.e., including the assembly or assemblies needed for removing of pollutants that are unavoidably entrained in air passed through the coating devices. Virtually all coating materials contain volatile pollutants that are noxious and sometimes even toxic so that the air must be thoroughly purified before it can be discharged into the atmosphere. Arrangement of two superimposed coating devices, each coacting with a deflector roller makes it difficult to provide adequate accessibility to the fountain roll, metering roll and applicator roll of the coating devices for the purpose of thorough cleaning. In particular, considerable difficulties

are encountered if the rolls of both coating devices are to be cleaned.

Moreover, lateral withdrawal of the rolls of each of the coating devices for purpose of cleaning also requires that each such roll is detached from its drive and such detachment, in turn, creates another problem since thorough cleaning of the rolls must be made while the rolls are turning. Hence, to effect such turning the rolls must be coupled to an auxiliary drive. After completion of the cleaning each roll must be detached from the auxiliary drive and re-attached to the drive of the device. All such decoupling, cleaning and recoupling obviously requires considerable time and labor and, thus, a corresponding increase in costs.

The sealed enclosure of the installation, i.e., the enclosure in which the coating device proper is located, is connected with a suitable suction pump for sucking off the volatile components released by the coating material. Such suction pump and the conduits connected therewith should be laid out so that a rapid air exchange is obtained to provide acceptable air conditions for the service personnel. The volume of air discharged from the space in which the coating is carried out can be fully fed to the drying assembly for drying of the coating material applied in the coating device only if and when this volume of air does not exceed the air requirements of the drying assembly. The drying assembly is coupled in its downstream position with an after-burning device. The purpose of such after-burner is to assure reasonably complete elimination of noxious or toxic pollutants. The level of air purification is generally controlled by strict codes which provide that the air discharged into the atmosphere cannot include more than a definite maximal percentage of pollutants.

To hold the operational costs of such after-burner assemblies as low as possible, efforts have been made to assure that the total volume of discharged air is reduced to an absolute minimum. To obtain optimal operational conditions for the installation it is advantageous that the total volume of air discharge can be processed in one after-burner assembly. However, such processing of the total air volume presupposes that the volume of air is discharged from the enclosure including one or more coating device can be fed to a drying assembly. This is only possible if the enclosed and sealed space for the coating devices, i.e., the overall dimensions of the enclosures for the coating devices is already at a minimum.

THE INVENTION

It is a broad object of the invention to provide a novel and improved coating device of the general kind above referred to in which the enclosure for the coating device and the coating device itself are reduced to minimal dimensions while at the same time obtaining maximal accessibility of the coating device for cleaning and other servicing.

Another object of the invention is to provide a novel and improved installation so arranged that the air flow which, after passing through enclosures for the coating device or devices has entrained therein pollutants, is limited to a volume of air which can be purified at optimal conditions.

SUMMARY OF THE INVENTION

The afore-pointed out objects, features and advantages and other objects, features and advantages which will be pointed out hereinafter are obtained by provid-

ing a coating device including a main frame structure, an auxiliary frame structure and a coating applicating assembly. The auxiliary frame structure supports the applicating assembly so that the same is displaceable in the direction normal to the path of the band or ribbon to be coated and is, in turn, supported by the main frame structure so that it can be displaced relative to said frame structure and also be detached therefrom. As a result, the over-all dimensions of the enclosure for the coating device can be selected so that the volume of air which must be passed through the enclosure during the coating operation can be held within limits which permit purification of the discharged air under optimal conditions and thus the volume of air continuously sucked out from the enclosure during a coating operation remains continuously at a rate which allows the use of economically acceptable after-burner assemblies. The discharge openings in the enclosures now need to be provided lengthwise of the bottom of the enclosure extending rows while heretofore additional crosswise extending air discharge openings were required.

The installation according to the invention further provides optimal accessibility of the coating devices proper so that servicing thereof, especially if, for instance, change in the color of the coating material is to be effected, can be carried out without considerable loss of time and without likelihood of insufficient cleaning of the rolls and other components of the coating device that need cleaning in case of change in the coating material.

After withdrawal of a coating device into the servicing position by a suitable power drive such as a servo system, the service personnel can clean or otherwise service the rolls of the coating devices while the rolls continue to rotate, as it is necessary for thorough cleaning and to effect such cleaning without first disconnecting the rollers from their operational drive means.

More specifically, the thorough cleaning of the rolls and other parts of the coating devices can be effected as sufficient space is available in a coating device according to the invention between the coating devices proper and the deflector roller over which the band or ribbon to be coated is guided during coating. Heretofore it was necessary for this purpose to effect time-consuming and complex lateral withdrawal or complete detachment of the coating device by means of a hoist. Such cleaning and other servicing of a coating device also results in avoidance of damage to the rolls which are comparatively expensive. Saving or reduction of the time required for cleaning the rolls of the coating device, and especially the applicator roll to effect rapid readying of the device in case of change in the color of the coating material or use of other coating materials, is of considerable economic significance, the more so as modern technique desires high conveying speeds for the band or ribbon to be coated. The importance of rapid readying of the coating device for re-start with a changed coating material is particularly important if comparatively small lots of bands or ribbon are to be coated. Obviously, the smaller the lot to be coated is, the more it becomes economically important to ready the entire installation for resuming operation with the changed coating material.

The invention also provides that the afore-referred to auxiliary frame structure is coupled to the main frame structure by means of clamping means which can be power operated, for instance by servo systems using hydraulic or air pressure. The use of such clamping means permits locking of the auxiliary frame structure to the main frame structure without tendency to vibrate, and simultaneously makes it easy to release the auxiliary frame structure from the main frame structure.

More specifically, operation of the clamping means is effected according to the invention by a power drive such as a cylinder-piston servo-system in which the connecting rod for the piston of the system mounts an angle lever mounting and operating clamping elements which are releasably engageable with complementary clamping elements on the auxiliary frame structure.

According to a further aspect of the invention, the auxiliary frame structure can be displayed relative to the main frame structure by a servo-system or other power drive which is mounted on the main frame structure. By operating this system, the auxiliary frame structure and with it the coating assembly supported on the same can be automatically detached from the main frame structure thereby obtaining clear space which is amply sufficient to carry out a thorough cleaning operation of the entire coating device without difficulty.

The air discharge and purifying parts and conduits which are disposed laterally of the main frame structure and the auxiliary frame structure can be used for immediate sucking out of air containing volatile pollutants or contaminants as may be released during a cleaning operation.

To permit continuous operation even during change of the coating material, the invention also provides that several coating devices are disposed each in a separate enclosure and in superimposition. These enclosed coating devices are connected with a common drying assembly and an after-burner assembly downstream of the drying assembly. The total discharge of contaminated air from the enclosures is fed to the drying assembly and the burner assembly by means of a suitable suction pump. Since the volume of air discharged from the enclosures in which the coating is carried out does not exceed the volume of air which can be accepted by the drying assembly, the total volume of air which contains a comparatively low amount of pollutants can be safely fed to the drying assembly. Additional content of pollutant as may be released in the drying assembly can subsequently be removed in the after-burner assembly. As a result, an additional after-burner assembly for the air discharged from the space in which coating is effected is thus avoided.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawing, preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is a diagrammatic elevational view of a coating device for coating both sides of a band or ribbon material in continuous operation;

FIG. 2 is a simplified plan view of FIG. 1; and

FIG. 3 is a diagrammatic elevational view of an installation including coating devices according to FIG. 1 disposed in superimposition for simultaneously or singly coating ribbons or bands and further including an air-purifying device.

DETAILED DESCRIPTION OF THE DRAWING

Referring now to the figures in greater detail, and first to FIG. 1, the coating device exemplified in this figure comprises a main frame structure 1 and an auxiliary frame structure 2. These frame structures mount

separate coating devices 3 and 4.

The main frame 1 further mounts two rotary deflector rollers 5 and 6 which serve to guide and convey a band or ribbon 7 to be coated. The auxiliary frame structure 2 mounts coating device 4 which is slidable relative to this frame structure by means of a guide slide 8. The coating device 4 is designed for coating the top or exposed side of band or ribbon 7 while coating device 3 serves for coating or otherwise treating the back side of the band or ribbon. The coating material may be any material suitable for the purpose, such as a dye, paint, lacquer, liquefied plastic, etc. Both coating devices are substantially alike as to their functional arrangement except that the coating device 4 being designed for coating the top side of the band or ribbon must be and is designed to effect a coating which satisfies high demand for uniformity, accuracy and similar requirements. Accordingly, device 4 includes various adjustment and control means which are not required for coating device 3 if, as is frequently the case, the demands on the quality of the coating on the back side are much lower than those for the coating of the top side.

Coating device 4 comprises an applicator roll 9, a fountain roll 10 for taking-up the coating material to be applied, and a metering roll 11. Similarly, the coating device 3 comprises an applicator roll 9', a fountain roll 10' and a metering roll 11'.

In addition to the afore-listed rolls, coating device 4 comprises guide carriers or slides 12, 13 and 14, each supporting one of the rolls. The positions of these slides and thus of the rolls relative one to another are adjustable by fine setting means such as hand wheels 18, 19 and 20 so that the cylindrical wall of the rolls are in coacting engagement, or in other words, the peripheral surface of one of the rolls rolls off the peripheral surface of the adjacent roll or rolls. Each of the three rolls is drivingly coupled by couplings 15, 16 and 17, respectively, with a separate drive means 21 (see FIG. 2).

Moreover, the entire coating device 4 can be by means of guide slide 8 which carries the guide slides 12, 13 and 14, displaced relative to the upper deflector roller 5 by means of a cylinder-piston-servo means 22 having a short stroke until stopped by an adjustable stop 37. The servo means 22 can be driven hydraulically or by air pressure. The purpose of the servo means is to move the coating device clear of the band when and while joints of lengths of band or ribbon pass the coating device, as such joints generally are somewhat thicker than the normal thickness of the band. After the passage of such joint the coating device is returned into its coating position. Control of the servo means can be automatically effected, for instance, by means of photocells or other control means conventional readily available in the market. The application of coating material is effected by transfer of material taken up by fountain roll 10 to metering roll 11, and finally, to applicator roll 9, which applies the coating material upon the upward facing band or ribbon 7 as the same is being guided and conveyed by deflector roll 5.

If the coating material is to be changed, for instance if material having a different color is to be used, rolls 9, 10 and 11 of coating device 4 and possibly other components thereof must be very carefully cleaned to prevent faulty coating such as discoloration, spots, etc. For the purpose of such cleaning, the entire coating device 4 can be displaced in the lengthwise direction of the coating device, that is, normal to the axis of roller 5, to a position in which there is free and convenient access to the device for cleaning the rolls and possibly other components.

To effect such convenient displacement of the coating device into and out of its operational position for the purpose of cleaning, the auxiliary frame structure 2 is displaceable on a guide means 23 which is mounted on the base or inserted into the base of auxiliary frame structure 2. Displacement of frame structure 2 is effected by suitable adjustment means such as a hydraulically operated servo-piston system 24. This servo-system is fixedly secured to main frame structure 1 and the piston rod 25 of system 24 can be moved into engagement with protrusions such as studs 26 on frame structure 2. Accordingly, by operating the servo system 24, its piston rod 25 can be used to move coating device 4 via auxiliary frame structure 2 into and out of its operational position.

Setting of auxiliary frame structure 2 and coating device 4 relative to deflector roller 5 is effected in the following manner: First, piston rod 25 of servo system 24 is operated to couple frame structure 2 with frame structure 1. As a result, there is a force-transmitting connection between both frame structures by means of a further power operated, for instance, hydraulically by a cylinder-piston servo system 27. The piston 28 of this system mounts a linkage 29 and 30 to which are hinged locking elements 31 and 32 which, upon operation of servo-system 27 effect coupling with coupling noses such as discs 33 and 34 on auxiliary frame structure 2.

After connection of frame structure 2 to frame structure 1, fine adjustment of rolls 9, 10 and 11 is effected by hand wheels 18, 19 and 20, respectively.

Operation of coating device 3 is essentially the same as that of coating device 4, except that adjustment and clearing of rolls 9', 10' and 11' is not or only rarely required since the quality demands on the coating of the bottom side of band or ribbon are much less on the coating of the top side as previously explained.

Turning now to FIGS. 2 and 3, these figures show application of the invention to an installation including two or more coating devices so that minimum space requirement is combined with convenient servicing of the coating devices as hereinbefore described. Furthermore, the installation due to the arrangement of coating devices according to the invention can be so designed that the air released during operation of the coating devices can be conveniently and thoroughly purified. Many types of coating materials such as certain paints, dyes, etc. contain volatile components which are released during application and drying and are obnoxious or even toxic. Accordingly, purification of the discharged air is highly necessary and often required by local codes.

FIGS. 2 and 3 show diagrammatically an installation which fully utilizes the advantages of coating devices according to the invention. As it is shown in these figures, each of the two coating devices is enclosed in a separate sealed-off enclosure 37 and 37', respectively. The outside dimensions of these enclosures can be conveniently selected in accordance with the minimal space requirements of the main frame structure and the auxiliary frame structure of coating device 4. There are shown two coating devices disposed in superimposition and enclosed by enclosures 37 and 37', respectively. Of course, there may be several enclosures side-by-side on the same level. More than two coating devices and enclosures therefor can be superimposed. Drying air after being drawn through the enclosures for the coating de-

vices is fed via discharge ducts **35** to air-purifying assemblies as it is shown in FIG. 3 to the right of the coating devices. Ducts **35** are preferably arranged parallel to each other as it is shown in FIG. 3 and also parallel to the bottom of the enclosures, thereby reducing the required space to a minimum. Moreover, due to such arrangement, the required air volume can be maintained so that the discharge of the total air volume from enclosures **37** and **37'** and the feed of this discharged air to the air purifying assemblies is made readily possible.

There is provided for each of the enclosures **37** and **37'** an air-purifying assembly. The assembly for coacting with enclosure **37** is fully shown and described, but the assembly for enclosure **37'** is only partly shown as the two assemblies are alike and function in the same manner.

The assembly coacting with enclosure **37** comprises a drying device **38** which, as shown, may be divided into several parts: a heat-exchanger **39**, burners **40**, one for each part of the drying device, an after-burner **41**, a suction pump **42**, and suction pumps **43**, one for each burner **40**. All these components are presumed to be of conventional design. The air used in enclosure **37** during the coating operations, which as previously becomes contaminated during and due to the coacting operations, is sucked out by means of suction pump **42** and fed via conduit **35** and heat-exchanger **39** to drying device **38**. The drying process in device **38** removes most of the contaminants in the air. The air is then returned to heat-exchanger **39** and from this exchanger to suction pump **42** through which it is discharged into the atmosphere. To assure still further purification of the air, the after-burner **41** may be interposed between the drying device and the heat exchanger. It has been found that reheating of the air while being dried in drying device **38** is necessary or, at least, desirable. For this purpose, part of the air in the drying device is sucked out by suction pumps **43** and exposed to the heat of burners **40** which causes not only reheating of the air but also the burning of pollutants or contaminants still contained in the air. The sucked-off air is returned into the drying device to be discharged therefrom into the atmosphere together with the air remaining in the drying device. Dotted arrowheads indicate the feed of air from the enclosure **38** into the drying device and solid arrowheads indicate the flow of part of the air as caused by suction pumps **43**.

As several coating devices are arranged in superimposition in FIG. 3 and each one is enclosed in an enclosure there is no undesirable delay in the carrying out of a coating operation in one of the coating devices when a change in the coating material is effected in another coating device. In other words, all coating devices can be kept in operation except the one in which a change in the coating material is made.

In case two superimposed coating devices are used for coating the top side of bands or ribbons within the same installation vibrations may occur when one of the coating devices is withdrawn for cleaning purposes or change in the coating material. The result of such vibrations would be irregularities in the coating as effected by the second coating device. This danger is avoided by providing separation of the coating devices by enclosures as it is shown in FIG. 3.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention, it will be understood by those skilled in the art, after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What is claimed is:

1. A coating device for coating bands with a coating material in continuous operation, said coating device comprising in combination:

a main stationary mounted frame structure;

rotary guide means for guiding band material to be coated, said guide means including at least one deflector roller and being mounted on said main frame structure;

a coating assembly for coating the side of the band outwardly facing on said roller, said assembly including a fountain roll for supplying coating material, a metering roll and an applicator roll disposed in axially parallel relationship one with the other and the deflector roller;

an auxiliary frame structure supporting said coating assembly, said auxiliary frame structure including guide means for slidably guiding said coating assembly as a unit in the direction normal to the rotary axis of the deflector roller for selecting varying positions of said assembly relative to said roller;

guide means on said main frame structure slidably supporting said auxiliary frame structure for selectively displacing the same in the direction normal to the axis as a unit relative to the main structure and thus relative to the deflector roller;

drive means for moving said auxiliary frame structure into a predetermined position relative to the main frame structure; and

locking means coacting with said auxiliary frame structure for releasably locking the same to the main frame structure.

2. A coating device in accordance with claim **1** wherein said drive means comprise a cylinder-piston servo means, the cylinder of said means being mounted on said main frame structure and the piston of said servo means being drivingly coupled with said auxiliary frame structure for displacing the same relative to the main frame structure by activating the servo means.

3. A coating device in accordance with claim **1** wherein said locking means comprise coating clamping members on the main frame structure and the auxiliary frame structure for releasably clamping the auxiliary frame structure in a selected position to the main frame structure.

4. A coating device in accordance with claim **3** wherein said clamping means comprise on one of the frame structures cylinder-piston servo means and linkage means coupled to the piston for controlling the position thereof in the cylinder and on the other frame structure retention means engaged with the linkage means in a predetermined position of said piston.

5. An installation for coating bands in continous operation, said installation comprising in combination:

a plurality of coating devices as defined in claim **1**;

a separate enclosure for each of said coating devices; and

an air purifying assembly for each of said enclosures, for removing pollutants released by the coating material and entrained in air, each of said assemblies comprising pump means, burner means for burning combustible pollutants entrained in air, drying means and conduits interconnecting each of said

enclosures with said pump means, said drying means and said burner means for forcing air flow sequentially through the respective enclosure, burner means and drying means thereby purifying the air and discharge means for discharging the purified air for the enclosures into the atmosphere.

6. An installation in accordance with claim 5 and comprising in each of said assemblies after-burner means interposed between said drying means and discharge means for discharging air into the atmosphere.

7. An installation in accordance with claim 5 wherein said enclosures are disposed in superimposition.

8. An installation in accordance with claim 7 wherein said conduits are disposed in mutually parallel relationship with and between the superimposed enclosures.

9. An installation in accordance with claim 7 and comprising heat-exchanger means for each of said assemblies, each of said heat-exchanger means being included in the respective conduits.

10. A coating device according to claim 1 and comprising second drive means for displacing said coating assembly relative to the auxiliary frame structure and thus relative to the selector roller.

11. A coating device according to claim 1 wherein said guide means on the auxiliary frame structure and on the main frame structure are linear guide means.

* * * * *

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United States Patent [19]

Preuss et al.

[11] **3,931,791**

[45] **Jan. 13, 1976**

[54] **MECHANISM FOR APPLYING LACQUERS AND THE LIKE ON A PRINTING PRESS**

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[21] Appl. No.: **503,475**

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[51] **Int. Cl.²** **B05C 1/02**

[58] **Field of Search** 118/262, 46, 236, 239, 118/231, 249, 250; 101/350

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[57] **ABSTRACT**

Sheet coating means for a printing press including a back-up cylinder and form cylinder having an associated fountain, the fountain having a fountain roller rotating adjacent the form cylinder. Also rotating adjacent the form cylinder is a first form roller which is coupled to the fountain roller via a dosing roller. The fountain and its associated rollers are mounted upon a subframe having provision for (a) shifting the fountain roller into liquid transmitting contact with the form cylinder and (b) shifting the first form roller into liquid transmitting contact with the form cylinder thereby, selectively, to change the length of the liquid transference path from the fountain to a sheet carried by the back-up cylinder in accordance with the drying speed of the coating material. In a preferred embodiment the fountain assembly includes a second form roller rotating adjacent the back-up cylinder for transmitting coating material directly from the fountain roller to the sheet thereby bypassing the form cylinder, extending the capability to use with coating materials of a viscous nature. Also in a preferred embodiment the fountain roller is driven by means separate from the press drive thereby to control the rate of application.

5 Claims, 4 Drawing Figures

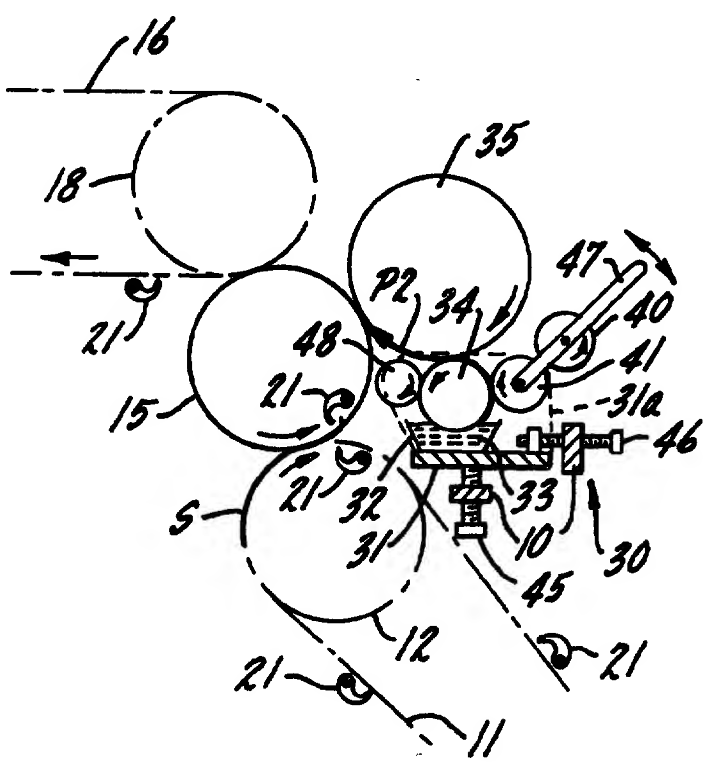


Fig. 1.

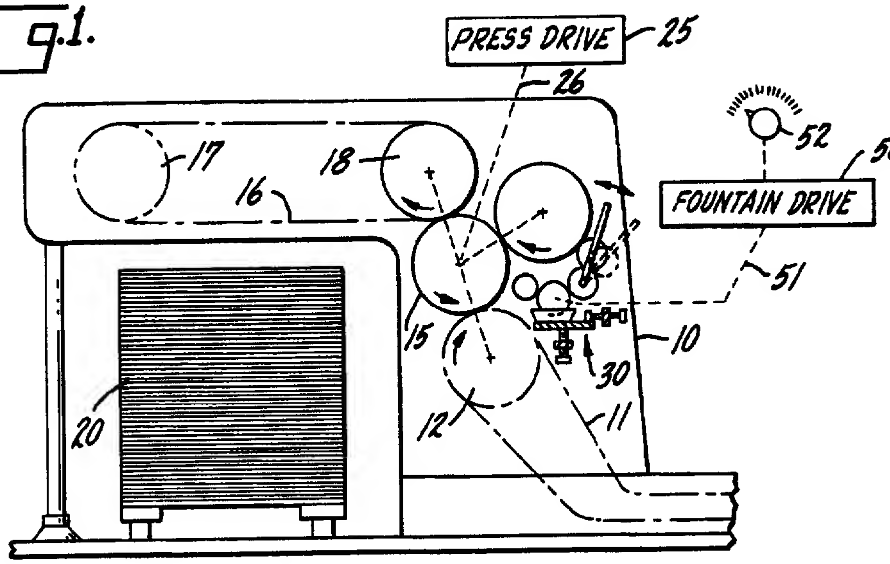
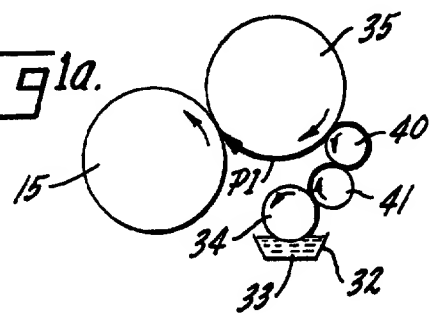


Fig. 1a.



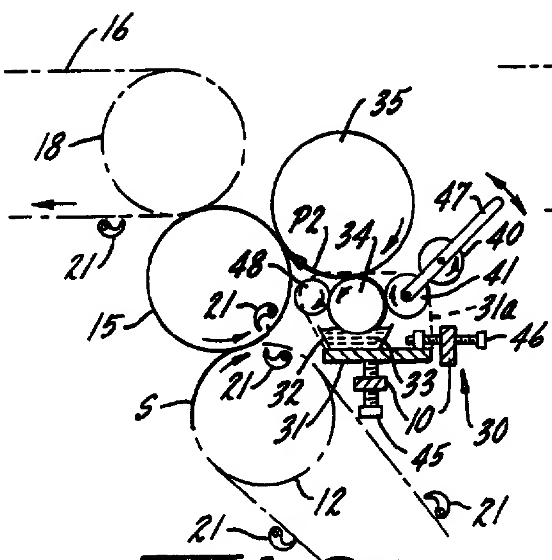


Fig. 2.

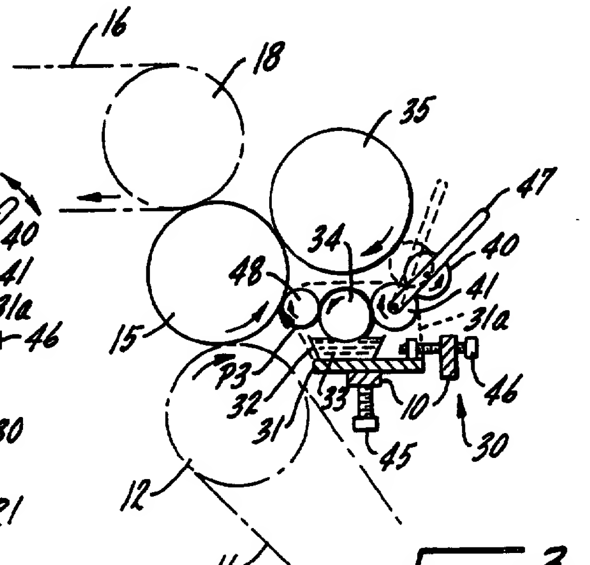


Fig. 3.

MECHANISM FOR APPLYING LACQUERS AND THE LIKE ON A PRINTING PRESS

In a sheet fed printing press, particularly of the lithographic type, it is frequently desired to coat a sheet with a liquid coating material, such as a lacquer, after the sheet has been printed and just prior to depositing the sheet on a delivery pile. It is, of course, desirable that the coating material be evenly distributed and applied while it is still in liquid form, before it dries on the rolls. Conventional coating assemblies have been capable of applying relatively slow drying materials, but when employed with fast drying materials the operation has not been successful since the material tends to dry before reaching the sheet. Nor are conventional coaters capable of handling coating materials having a wide range of drying time or wide range of viscosity.

It is, accordingly, an object of the present invention to provide a coating arrangement for use in connection with a lithograph printing press which overcomes the disadvantages of prior coaters and which is highly flexible, being capable of coating with a wide variety of materials having different drying times and different viscosities but which is, nonetheless, simple and economical in construction.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 shows the delivery end of a lithographic printing press including a coating mechanism in accordance with the present invention;

FIG. 1*a* is a fragmentary diagram showing the fluid path in FIG. 1;

FIG. 2 is a diagram showing the arrangement of FIG. 1 in an alternate mode.

FIG. 3 is a similar diagram showing a still further operating mode.

While the invention has been described in connection with a preferred embodiment, it will be understood that we do not intend to be limited to the embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1 there is shown the delivery end of a printing press having a frame **10** and to which sheets are individually delivered upon a chain type conveyor **11** in which the chains are trained about a pulley **12**. From the conveyor **11** sheets are individually passed to a back-up cylinder **15** and thence to a final chain type conveyor **16** having pulleys **17, 18**. From the conveyor **16** sheets are deposited in a pile **20**. The conveyor **11**, cylinder **15** and conveyor **16** have, for simplicity, been shown in diagrammatic form. It will be understood that each of these includes grippers, generally indicated at **21** (FIG. 2) for engaging the leading edge of a printed sheet together with means for synchronously operating the grippers to effect transfer of the sheet from conveyor **11** to cylinder **15**, and from cylinder **15** to conveyor **16**, from which the sheet is dropped onto the pile. Also for the sake of simplicity the press drive **25** and drive train **26** have been shown diagrammatically, with the understanding that both driving and sheet transfer, from conveyor to cylinder and vice versa, are well understood to those skilled in the art, cross reference being made to the patent literature for the details of construction.

For the purpose of coating a sheet (a typical sheet being indicated at S in FIG. 2) as it is transported on the back-up cylinder **15**, a fountain assembly **30** is provided including a subframe **31**. Mounted on the subframe is a fountain **32** having a body of liquid coating material **33**. Journaled in the subframe, for example, in side plates outlined at **31*a***, and with its lower surface projecting into the body of coating material, is a fountain roller **34** (see especially FIG. 2). For receiving a film of the coating material from the fountain roller and for transmitting it to a sheet conveyed by the back-up cylinder **15**, a form cylinder is provided. Such form cylinder, indicated at **35**, is journaled in the press frame **10** and synchronously driven via the drive train **26**.

In accordance with the present invention the fountain roller **34** is equipped with a dosing roller and form roller which is engageable with the form cylinder to provide an alternate and longer path of liquid application. Thus we provide, in a position adjacent the form cylinder **35**, a form roller **40**. Interposed between the form roller **40** and the fountain roller **34**, to provide communication between them, is a dosing roller **41**. The form roller **40** and dosing roller **41** are both journaled for rotation in the subframe **31** and the subframe is so mounted and constructed, for shifting movement, that the fountain roller **34** and form roller **40** may be selectively engaged with the form cylinder **35**. To permit movement of the subframe **31** it is floatingly mounted with respect to the main frame **10**, with its position being determined by adjustable shifting means. In the illustrated embodiment shifting of the subframe **31** in the vertical direction is accomplished by an adjusting screw **45** while shifting in the horizontal direction is brought about by an adjusting screw **46**, both adjusting screws being threadedly related to the main frame **10**. It will be apparent that by unscrewing the adjusting screw **45** the level of the subframe **31** may be dropped to disengage the fountain roller **34** from the surface of the form cylinder **35**.

In carrying out the present invention the shifting means preferably includes means for shifting the form roller **40** toward and away from the surface of the form cylinder **35**, that is, in the direction of the arrows shown in FIG. 1. To this end the subframe includes a pair of arms **47** (only one of which is shown) which may be pivoted about the axis of the dosing roller **41** and with suitable means (not shown) for holding the arms in a desired operating position.

By manipulation of the shifting means, alternate paths are provided for the costing liquid proportioned in accordance with drying time. Thus referring to FIGS. 1 and 1*a*, the form roller **40** is advanced into liquid transmitting contact with the surface of the form cylinder **35**, while the fountain roller **34** is retracted therefrom, to produce a liquid transference path **P1**. Such path is lengthy and suited to coating liquids having a relatively long drying time. Indeed, the path is sufficiently long so that volatile elements in the coating material are permitted to escape during the time that the coating material is formed into a smooth film by the action of the rollers **34, 41, 40** and cylinder **35**, against one another. Thus when the coating material is transferred onto the sheet at the end of the path **P1** it is still in liquid form but it is nonetheless preconditioned for drying after it is deposited upon the surface of the sheet so that the sheets do not stick together upon being deposited on the pile **20**.

Alternatively, the supporting arms **47** (FIG. 2) may be swung away from the form cylinder **35** to retract the form roller **40** from contact, and the adjusting screw **45** may be screwed in to raise the subframe **31** to engage the fountain roller **34** with the surface of the form cylinder thereby to create a short transference path indicated at P2. The path is sufficiently short so that the coating liquid from the fountain is almost immediately applied to the sheet on the back-up cylinder without opportunity for drying to take place on the form cylinder. The mode illustrated in FIG. 2 is, therefore, ideally suited for use with coating liquids having a short drying time.

It will be noted that the rollers, and cylinder **35**, are compatible in both of the modes of operation. Assuming that the form cylinder **35** is resiliently surfaced, the form roller **34** may be hard surfaced and in slightly indenting relation to insure that a smooth film is transferred along the path P2. Further, the dosing roller **41** is resiliently surfaced, and the form roller **40**, unlike most conventional form rollers, is hard surfaced, indenting both the dosing roller and form cylinder so that a similar film, in even thickness, is transferred along the path P1. Moreover, it will be noted that the directions of the rollers are, in both modes, completely compatible, with the dosing roller **41** not only preserving the "hard-soft" order of the rollers but causing movement of the form roller surfaace **40** to be in the same direction as the surface of fountain roller **34** as required for alternate engagement. Thus it is a feature of the invention that the direction of the fountain roller is preserved in all operating modes.

In accordance with the preferred embodiment of the present invention an auxiliary, or second, form roller **48** is provided mounted on the subframe **31**, interposed between the fountain roller and the back-up cylinder, and selectively engageable with the surface of the latter, so that the coating material from the fountain may be applied directly to the sheet on the back-up cylinder, thus bypassing the surface of the form cylinder **35**. Such mode of operation, illustrated in FIG. **3**, is especially suited for use with coating materials of a viscous nature, for example, certain viscous varnishes. To achieve the mode of operation shown in FIG. **3** the adjusting screw **45** and arms **47** are retracted, and adjusting screw **46** is advanced to shift the fountain subframe **31** horizontally to bring roller **48** against the surface of the back-up cylinder **15**. This provides a transference path P3 which may, depending upon the diameter of the roller **48**, be somewhat shorter than the path P2 previously mentioned.

It may be noted that while the assembly of rollers and cylinders discussed above provides three distinct, alternative modes of operation, all of the components in the system are, nevertheless, at all times active. Thus in the mode illustrated in FIG. **1**, in which transference occurs via rollers **41, 40**, the roller **48**, by its continued rotation, performs a smoothing function, and this is also true of the mode shown in FIG. 2. Similarly, while rollers **40** and **41** are inactive in the modes of FIGS. **2** and **3** as far as liquid transference is concerned, such rollers, by their continuous rotation, continue to provide a smoothing function, insuring that the film which is transferred along paths **P2, P3** is of an even and consistent nature. Thus the coating means, in addition to accommodating different drying times and different viscosities, is eminently usable with liquids that are difficult to spread, in an even film, in coating devices of more conventional design.

In the above discussion it has been assumed that the fountain roller and associated rollers are rotated either as the result of surface friction or by providing a suitable and synchronized drive connection with drive train **26**. However, it is one of the features of the present invention that the fountain roller **34** is provided with separate driving means diagrammatically indicated at **50** in FIG. **1** and which includes a fountain drive train **51** with the speed of the drive being capable of separate manual adjustment by means of an adjusting knob **52**, reference being made to the art relating to controlled speed drives for the details of construction. By separate control of the speed of rotation of the fountain roller **34**, the rate at which the coating liquid is drawn from the fountain and hence the thickness of application to the sheet is under the precise control of the operator, with the difference in surface speed being accommodated by slippage, for example, by slippage at the surface of the fountain roller.

In the exemplary embodiment it will be noted that two separate means have been disclosed for achieving movement of the rollers. Thus the rollers may be mounted for bodily shifting movement with a subframe, such as subframe **31**, as in the case of roller **34**, or the rollers may be mounted for individual shifting, or swinging movement, as in the case of the roll **40** which is swingable on arms **47**. If desired, the second form roller **48** may be swingably mounted in the same way as roller **40** for individual movement into and out of engagement with the back-up cylinder. Also if desired the form roller **34** may be individually mounted for movement vertically from the directly transferring position shown in FIG. **2** downwardly, accompanied by deeper submergence into the fountain, into the position shown in FIG. **3**. The term "means for shifting the subframe" as used herein therefore includes the relative shifting of rollers with respect to the subframe. Selection of length of path "in accordance with drying speed" shall mean that a long path corresponds to a relatively slow drying speed and vice-versa.

While adjusting screws have been shown simply to illustrate the principle of operation, one skilled in the art will appreciate that in practice throw-over cams or eccentrics may be substituted to simplify shifting between precise alternate positions. The term fountain includes generally means for furnishing liquid to a fountain roller.

What is claimed is:

1. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing the sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a first form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the first form roller, and a second form roller interposed between the fountain roller and the back-up cylinder, and means for selectively shifting the fountain roller and form rollers with respect to the main frame to (a)

bring the fountain roller into exclusive liquid transmitting contact with the form cylinder, to (b) bring the first form roller into exclusive liquid transmitting contact with the form cylinder and to (c) bring the second form roller into exclusive liquid transmitting contact with the back-up cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material and to insure evenly distributed liquid application of the coating material to the sheet.

2. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing a sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly having a sub-frame mounted on the main frame and shiftable with respect to it, the fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the form roller, and means for selectively shifting the sub-frame with respect to the main frame into alternative conditions to (a) bring the fountain roller into exclusive liquid transmitting contact with the form cylinder and to (b) bring the form roller into exclusive liquid transmitting contact with the form cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material to insure evenly distributed liquid application of the coating material to the sheet.

3. The combination as claimed in claim 2 in which a separate drive independent of the press drive is provided for the fountain roller.

4. The combination as claimed in claim 3 in which the drive is provided with speed adjusting means permitting a surface speed lower than press speed for controlling the rate at which the liquid coating material is fed from the fountain.

5. For use with a sheet-fed printing press, means for applying a liquid coating material to a sheet following the printing thereof which comprises a main frame, a back-up cylinder journaled in the main frame, means including grippers for transferring a sheet to the back-up cylinder for transport thereon and for removing the sheet therefrom for delivery, a form cylinder journaled in the main frame in rolling engagement with the back-up cylinder, means for driving the cylinders and gripper means in unison, a fountain assembly including a fountain for the coating material, a fountain roller rotating therein adjacent the form cylinder, a first form roller adjacent the form cylinder, a dosing roller communicatingly interposed between the fountain roller and the first form roller, and a secoond form roller interposed between the fountain roller and the back-up cylinder, and means for selectively shifting the fountain roller and form rollers with respect to the main frame to (a) bring the fountain roller into exclusive liquid transmitting contact with the form cylinder, to (b) bring the first form roller into exclusive liquid transmitting contact with the form cylinder and to (c) bring the second form roller into exclusive liquid transmitting contact with the back-up cylinder thereby to change the length of the liquid transference path from the fountain to the sheet in accordance with the drying speed of the coating material and to insure evenly distributed liquid application of the coating material to the sheet, the rollers being surfaced to produce an alternating hard-soft liquid transfer sequence and the cylinders being driven without reversal of direction during all three exclusive liquid transmitting modes.

* * * * *

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United States Patent [19] [11] 4,222,325
Edwards [45] Sep. 16, 1980

[54] MOUNTING MEANS FOR MOVABLE CARRIAGE ON AN OFFSET PRESS

[75] Inventor: Robert Edwards, Dudley, Mass.

[73] Assignee: White Consolidated Industries, Inc., Cleveland, Ohio

[21] Appl. No.: 936,826

[22] Filed: Aug. 25, 1978

[51] Int. Cl.[3] B41F 7/08; B41F 7/40; B41F 31/34

[52] U.S. Cl. 101/137; 101/148; 101/177; 101/185; 101/247; 101/351; 101/248

[58] Field of Search 101/177, 183, 184, 185, 101/136, 137, 140, 141, 142, 143, 144, 145, 247, 209, 351, 352, 178, 182, 138, 139, 179, 180, 181, 148

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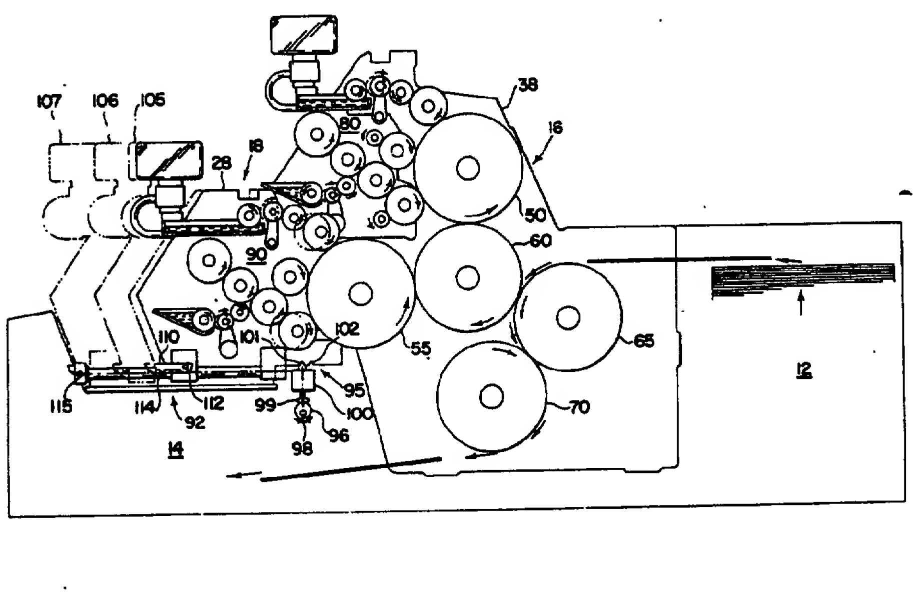
Primary Examiner—J. Reed Fisher
Attorney, Agent, or Firm—Pearne Gordon Sessions

[57] ABSTRACT

A two-color offset printing press having two plate cylinders simultaneously engageable with a single blanket cylinder is disclosed. The plate cylinders and a blanket cylinder are rotatably mounted on a printer head fixed to the mainframe of the press. A first set of dampening and inking rollers is mounted on the printer head and engageable with one of the plate cylinders. A second set of dampening and inking rollers, engageable with the other plate cylinder, is mounted on a ball bushing supported carriage linearly movable to and from the printer head along a pair of parallel rails fixed to the mainframe. Image registry between the two plate cylinders is established by an operator-accessible adjustment mechanism for shifting one of the plate cylinders back and forth along its axis of rotation. An electrical safety interlock system precludes operator access to the carriage-associated plate cylinder during predetermined operating modes of the press.

2 Claims, 13 Drawing Figures



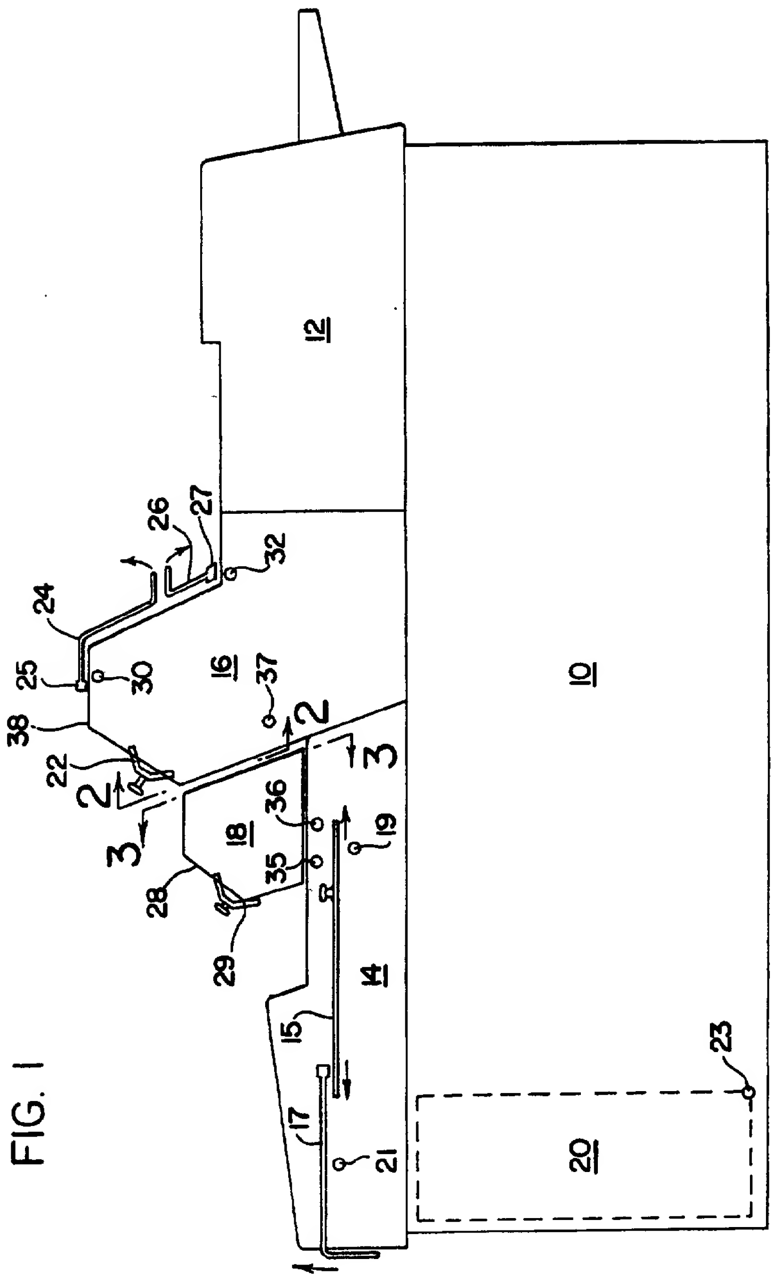


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FIG. 1

FIG. 3

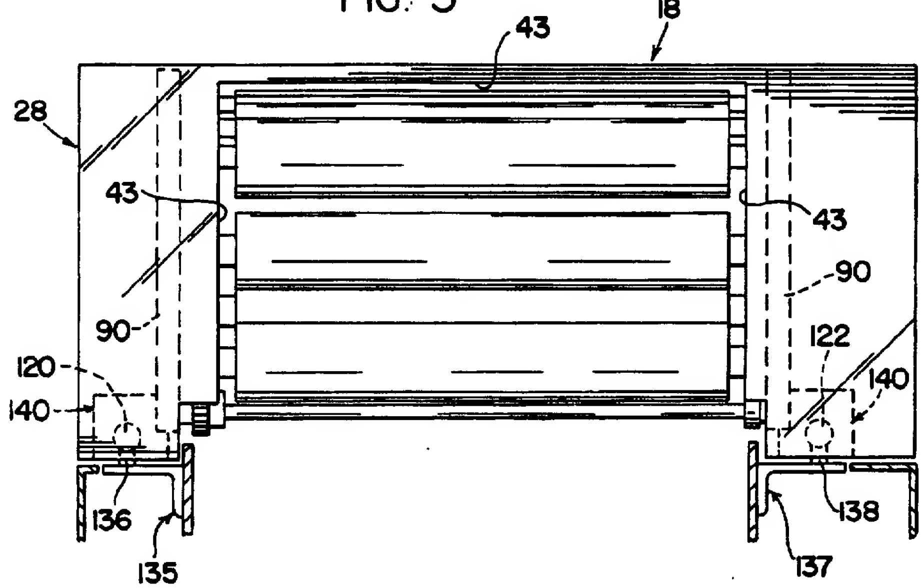


FIG. 2

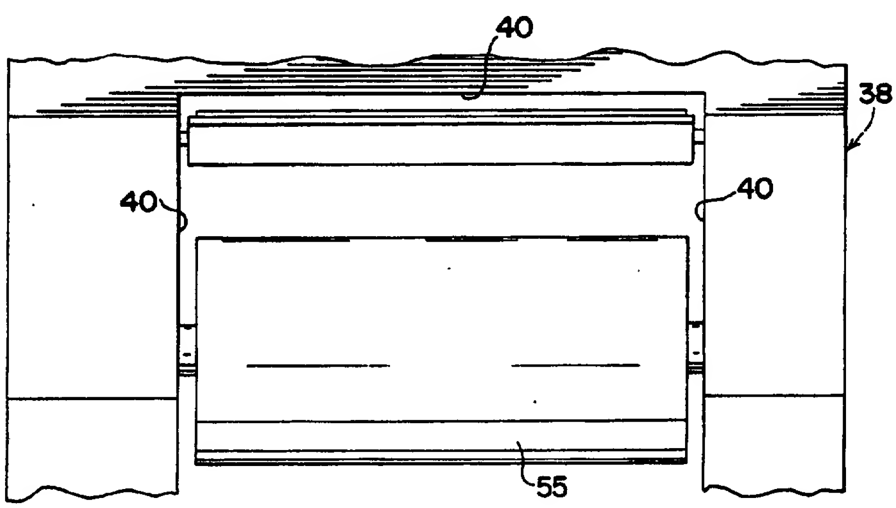
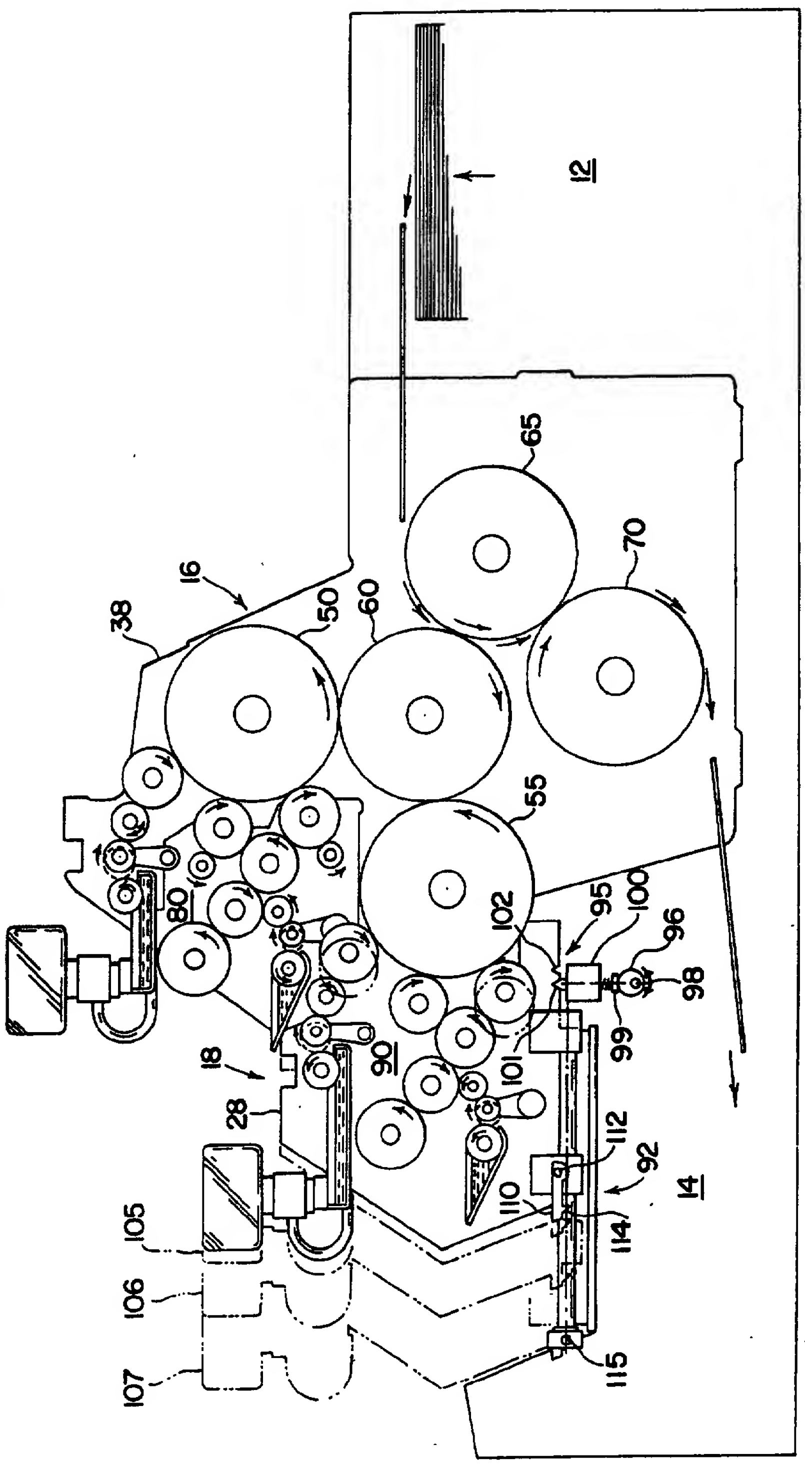


FIG. 4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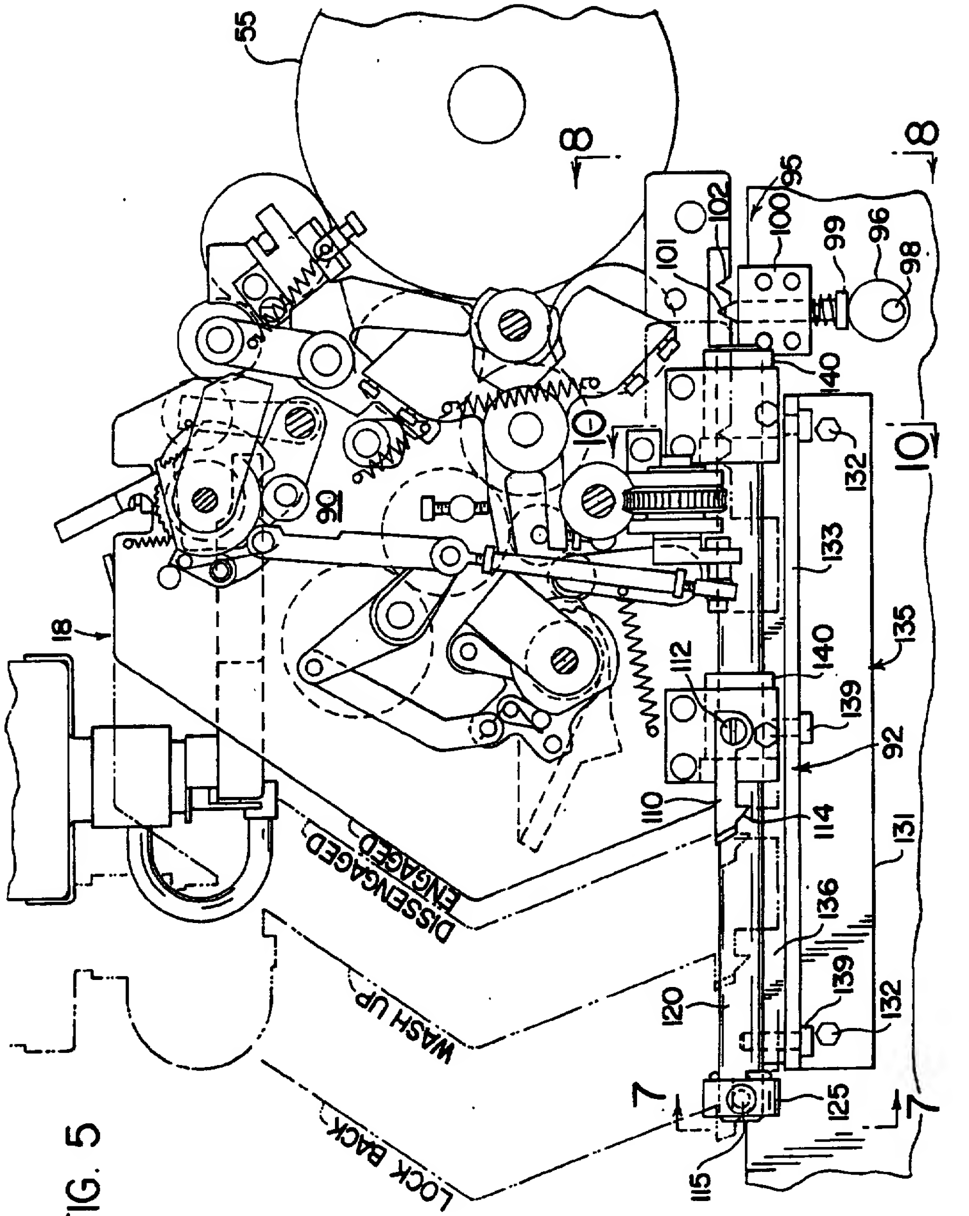

FIG. 5

FIG. 7

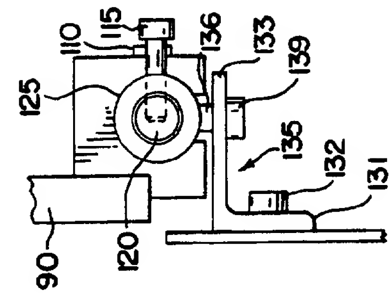
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FIG. 6

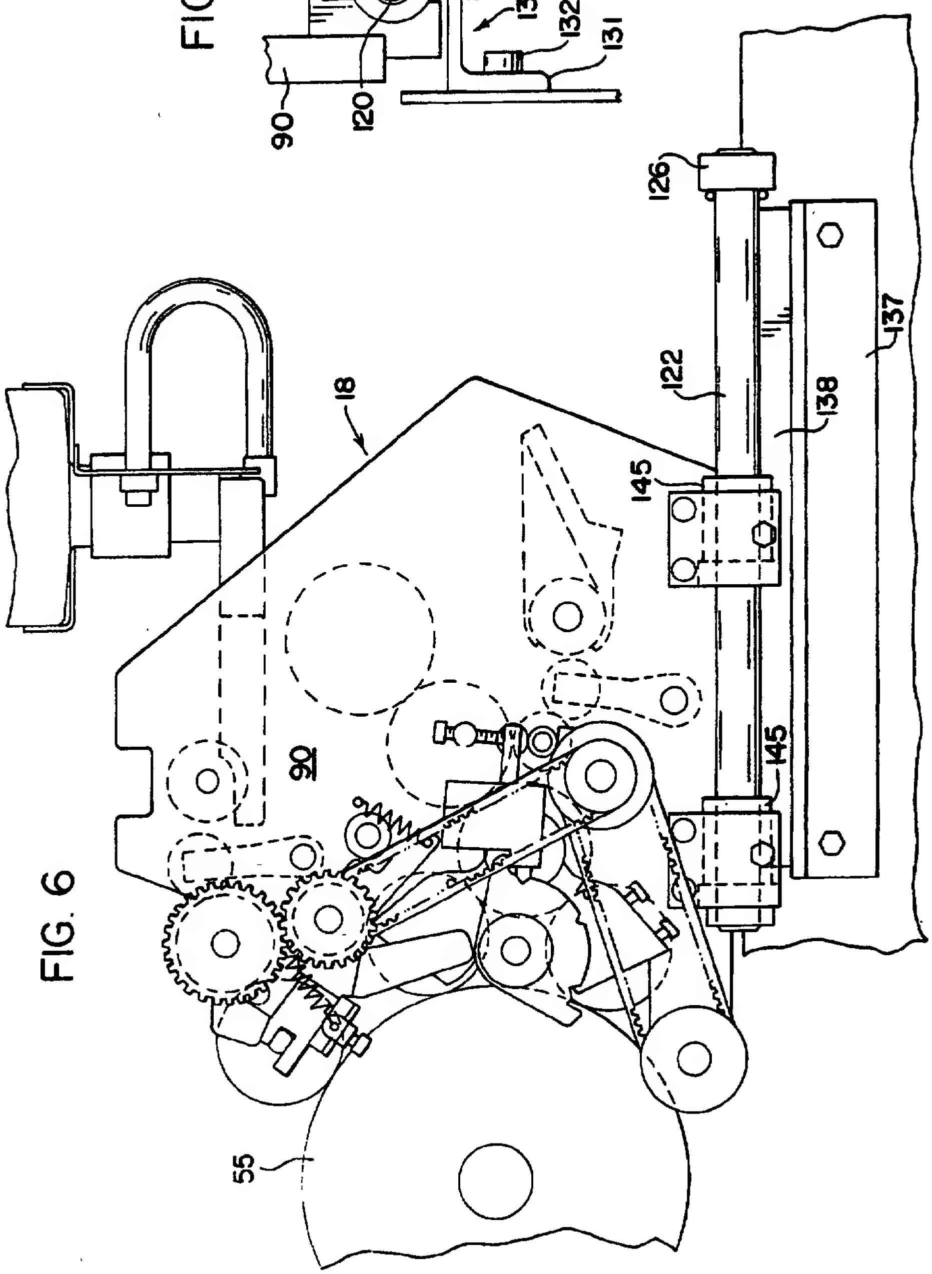
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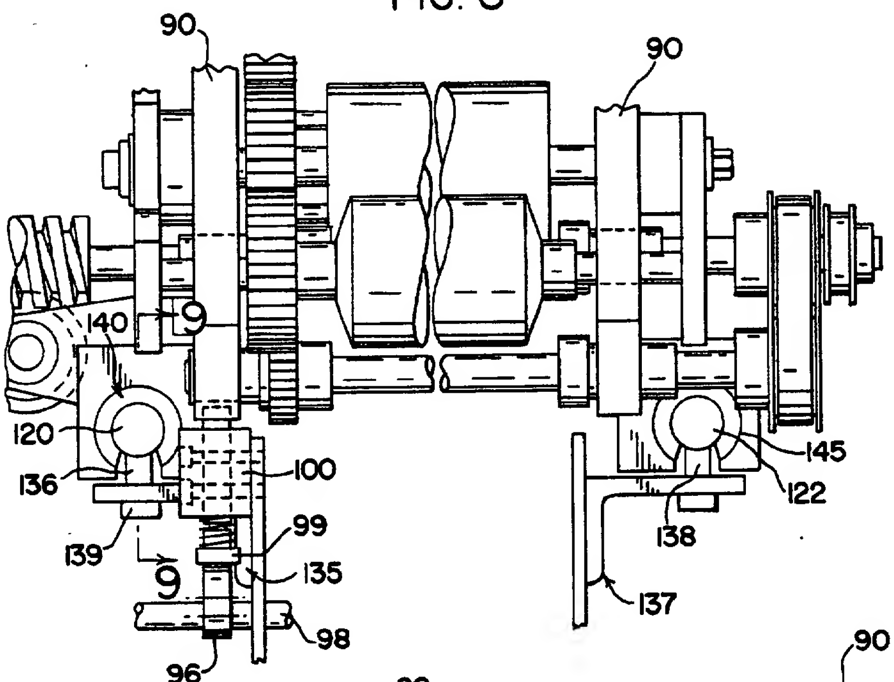
FIG. 8



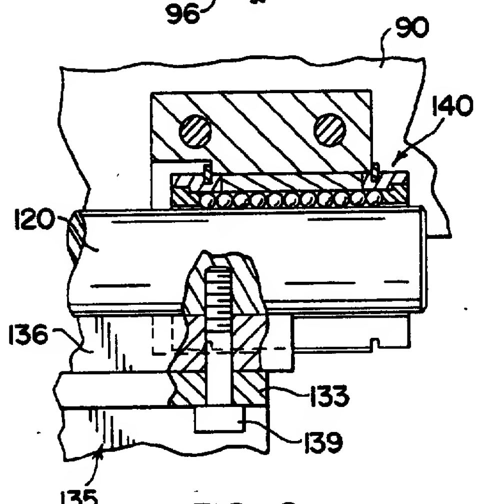


FIG. 9

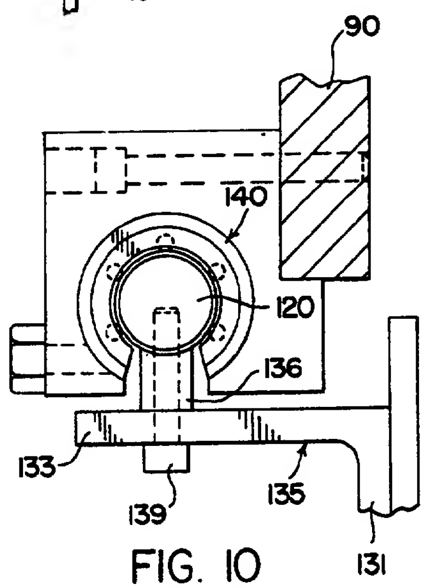


FIG. 10

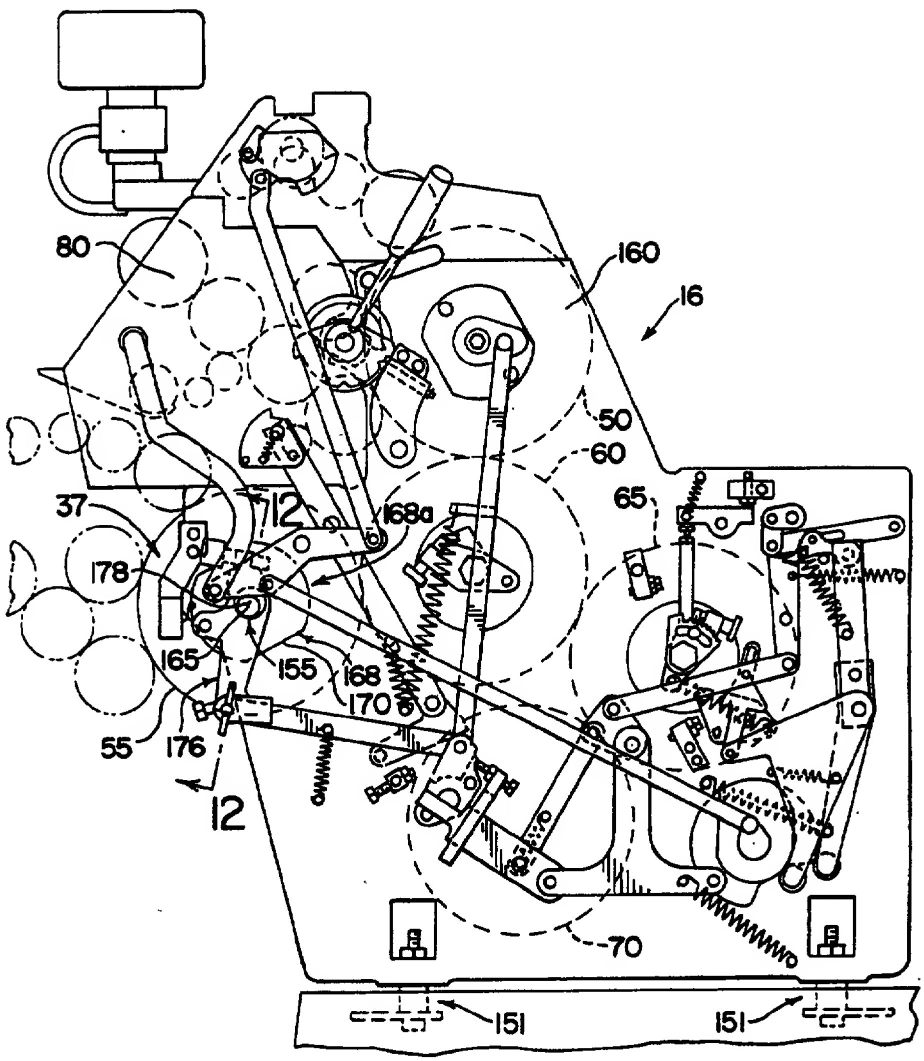

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FIG. 11

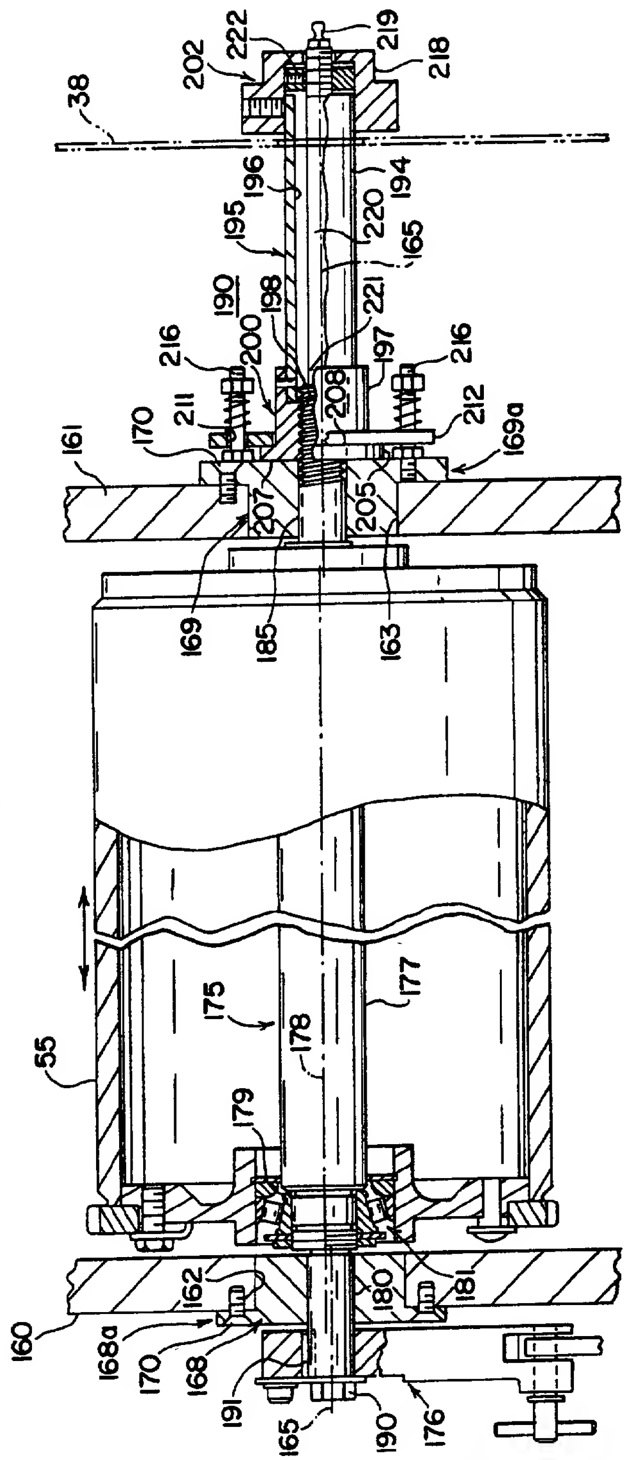

FIG. 12

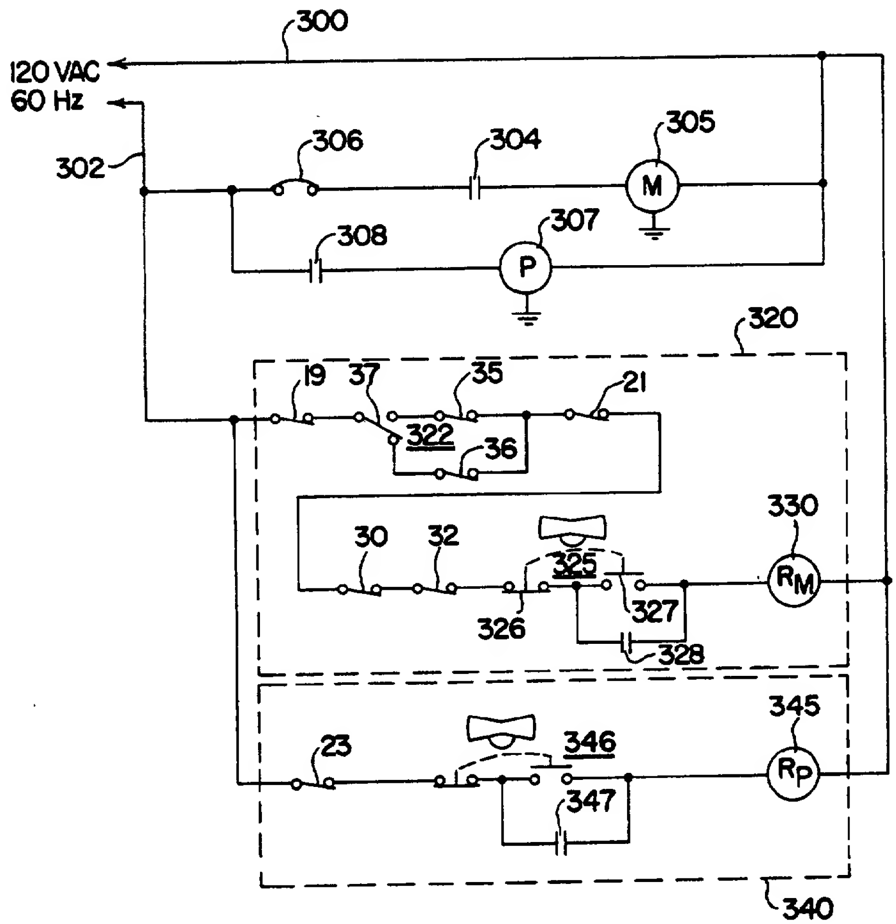
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FIG. 13

MOUNTING MEANS FOR MOVABLE CARRIAGE ON AN OFFSET PRESS

BACKGROUND OF THE INVENTION

This invention relates to offset printing, and in particular to an offset printing press having a dampening and inking roller-containing carriage linearly movable to and from an associated plate cylinder.

The set of dampening and inking rollers on the carriage, when moved to an engagement position with a respective plate cylinder, must be properly positioned relative to the plate cylinder to provide controlled amounts of inking and dampening fluid to the plate cylinder. To provide such proper positioning, it is necessary that lateral and skewing movements of the linearly movable carriage be eliminated.

The prior art, as represented by U.S. Pat. No. 3,521,559 to Sejeck et al., is intended to provide proper positioning of a linearly movable ink roller-containing carriage relative to its respective plate cylinder by the use of interlocking abutting slide members of wear-resistant, low friction, synthetic resin. The slide members are intended to preclude lateral shifting or skewing of the carriage to provide for proper positioning of the carriage-contained ink rollers relative to their respective plate cylinder. Such a slide arrangement is further intended to give all the benefits of a more expensive machined dovetail slide arrangement.

While the Sejeck et al. slide arrangement may represent a cost improvement over a conventional dovetail type slide, such a slide arrangement would still be susceptible to surface-to-surface sliding friction wear as is a dovetail-type slide. Further, the weight of the moving carriage may have to be limited to prevent degeneration of the relatively soft synthetic resin material used to form the Sejeck et al. carriage-supporting slide members.

SUMMARY OF THE INVENTION

In accordance with the present invention, a printer head, including at least one rotatably mounted blanket cylinder and at least one rotatably mounted plate cylinder engageable with the blanket cylinder, is mounted on and fixed to a mainframe which supports a dampening and inking roller-containing carriage linearly movable to and from the printer head on a set of rolling-friction bearing surfaces. The carriage is positively lockable at predetermined locations lying along its linear path of movement to and from the printer head. In a preferred form the invention includes a plurality of linear motion ball bushings fixed to the carriage. The bushings in turn ride on a pair of mainframe-supported circular cross section rails that are parallel to and lie along either side of an axis normal to the axis of rotation of the plate cylinder which engages the set of dampening and inking rollers on the movable carriage when it is in an engagement position closest to the printer head.

The invention provides accurate linear movement of the carriage relative to its associated plate cylinder without lateral or skewing movements of the carriage, such positive linear motion precluding misalignment of the plate cylinder and its carriage-mounted set of dampening and inking rollers. Linear carriage movement is provided by the present invention at a relatively low cost and with high reliability. The rolling friction bearing surfaces provided by the preferred linear motion ball bushings in accordance with the invention advantageously provide extremely low friction movement of the carriage as opposed to the higher surface-to-surface friction slide mechanism of the prior art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic elevation view from the operator's side of a two-color offset printing press, with covers in place, in accordance with the present invention;

FIG. 2 is an elevation view of the printer head of the press taken along line 2—2 of FIG. 1;

FIG. 3 is an elevation view of the movable carriage of the press taken along line 3—3 of FIG. 1;

FIG. 4 is a schematic elevation view from the operator's side of the press, with covers removed;

FIG. 5 is an operator's side, elevation view of the movable linking and dampening roller-containing carriage illustrating various carriage positions;

FIG. 6 is a nonoperator's side, elevation view of the movable inking and dampening roller-containing carriage supported by linear motion ball bushings;

FIG. 7 is an end view of a portion of the carriage mounting means taken along line 7—7 of FIG. 5;

FIG. 8 is an end view of the press carriage, with portions cut away, taken along line 10—10 of FIG. 5;

FIG. 9 is a longitudinal, cross section view of one of the ball bushing mountings of the carriage taken along line 9—9 of FIG. 8;

FIG. 10 is a transverse, cross section view of one of the ball bushing mountings of the carriage taken along line 10—10 of FIG. 5;

FIG. 11 is an operator's side, elevation view of the printer head of the press;

FIG. 12 is a longitudinal cross section view of the axially adjustable plate cylinder taken along line 12—12 of FIG. 11; and

FIG. 13 is a schematic diagram of the printing press safety interlock system.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, there is schematically illustrated in elevation a two-color offset printing press in accordance with the present invention wherein a mainframe 10 having a paper feed input 12 and a paper delivery output 14, supports a fixed printer head 16 and a carriage 18 linearly movable to and from the printer head 16.

The printer head 16 includes a pair of plate cylinders engageable with a blanket cylinder, in turn engageable with an impression cylinder, in turn engageable with a delivery cylinder. The printer head 16 further includes a first set of dampening and inking rollers engageable with one of the plate cylinders.

The movable carriage includes a second set of dampening and inking rollers engageable with the other plate cylinder mounted on the printer head.

The detailed structure of the printer head 16 and carriage 18 will be illustrated and discussed subsequently.

By way of example, and with further reference to FIG. 1, in a typical offset printing operation, blank printing paper in a stream of sequentially fed separate sheets, is provided by the paper feed input 12 to the printer head 16 wherein the paper passes between the image-containing blanket cylinder and an impression cylinder, the image on the blanket cylinder being transferred in a well-known manner to the paper. The

printed paper is then transferred via the paper delivery output 14 from the printer head 16 into a conventional vertically extending sheet stacking bin 20. The feeding of the printing paper to the printer head 16 by the paper feed input 12 and the delivery of the printed paper from the printer head 16 to the bin 20 by the paper delivery output 14 are provided by conventional chain transport systems well-known in the art.

To ensure safe operation of the press of the present invention, a plurality of fixed and movable covers are provided to limit operator access to moving parts of the press. The printer head 16 includes a cover 22 and two cooperating plate cylinder covers 24, 26, as shown in FIG. 1. The covers 22, 24, 26 serve to close printer head access openings used for maintenance or set-up of the press in a non-running condition. The plate cylinder covers 24, 26 are each pivotal about respective hinge joints 25, 27 fixed relative to the printer head 16. Associated with the covers 24, 26 are respective interlock switch means 30, 32 which are responsive to movement of their respective associated covers 24, 26 wherein opening and closing of the covers 24, 26 actuate the interlock switches 30, 32. In a manner to be subsequently explained in detail, opening of the covers 24, 26 by moving either of them pivotally away from the printer head 16 actuates the respective interlock switches 30, 32, which in turn deenergize the press drive motor to preclude operator access to moving press parts such as rotating cylinders and rollers mounted on and within the printer head 16. The cover 22 and movable covers 24, 26 cooperate with a printer head housing 38 to generally enclose the cylinder and rollers within the interior volume generally defined by the printer head housing 38.

The paper delivery output 14 includes a linearly slidable cover 15 and a cooperating pivotal cover 17, which limits operator access to the paper delivery chain drive when the paper delivery covers 15, 17 are in their closed position as illustrated in FIG. 1. Associated with the covers 15, 17 are respective interlock switch means 19, 21 which function to deenergize the press motor when the respective covers are in an open position as opposed to their closed illustrated positions. A bin overload interlock switch means 23 functions to deenergize the paper feed process when the bin 20 is full.

The carriage 18 includes a housing 28 and a cover 29 which generally encloses the interior mechanism of the dampening and inking roller-containing carriage 18, such mechanism to be explained subsequently in detail. Two carriage-related interlock switches 35, 36 are responsive to linear movement of the carriage 18 away from and toward the printer head 16. The carriage-related interlock switches 35 and 36 cooperate with a plate cylinder interlock switch means 37, the switching means 37 being responsive to the movement of a carriage-associated, printer head-mounted, plate cylinder into and out of an engaged position with the printer head-mounted blanket cylinder. The cooperating switch means 35, 36, 37 function together to limit operator access to moving parts within the printer head housing 38 and the carriage housing 28 when the carriage 18 is pulled back away from the printer head 16.

The heretofore discussed switch means are preferably in the form of mechanical microswitches, although other types of switches, such as optical coupler-type relays, are clearly applicable. The precise manner in which the above-noted plurality of interlocking switching means cooperate to deenergize the press motor to preclude unsafe operation of the press will be subsequently explained in detail.

With reference to FIG. 2 taken along line 2—2 of FIG. 1, it can be seen that the printer head housing 38 provides an edge wall 40 which circumscribes and defines a rectangular aperture for operator access to the interior of the housing 38 containing the printer head-mounted cylinders and rollers.

With reference to FIG. 3 taken along line 3—3 of FIG. 1, it can be seen that the carriage housing 28 has an edge wall 43 which circumscribes and defines a rectangular aperture for access to the interior of the dampening and inking roller-containing carriage housing 28.

When the carriage 18 is pulled back or withdrawn away from the printer head 16 to a prescribed degree, operator access to both the interior of the carriage housing 28 and the interior of the printer head housing 38 is provided via the noted rectangular apertures. When the carriage 18 is moved to a position closest to the printer head 16, the housing edge walls 40, 43 abut in opposing relation (FIG. 1) to limit operator access to the interior of the housings 28 and 38 wherein the housings cooperate with each other and with the earlier-noted covers 22, 24, 26, 29 to generally enclose the cylinder and roller mechanisms of the printer head 16 and carriage 18, respectively.

Turning to FIG. 4, there is illustrated, in accordance with the invention and in a more detailed manner, the printer head 16 and the carriage 18, which are generally enclosed by their respective housings 28, 38, schematically represented in outline fashion. The printer head 16 includes a first plate cylinder 50, a second plate cylinder 55, a blanket cylinder 60, an impression cylinder 65, and a delivery cylinder 70.

The plate cylinders 50, 55, the blanket cylinder 60, the impression cylinder 65, and the delivery cylinder 70 are interengageable and rotatably mounted on the printer head 16. Each of the cylinders 50, 55, 60, 65, 70 lies along parallel axes of rotation with their outer surfaces of revolution in generally opposed, abutting relationship, as illustrated. Associated with and mounted on and fixed to the printer head 16 is a first set of dampening and inking rollers 80 rotatable on axes of rotation parallel to the axes of rotation of the printer head cylinders. The set of dampening and inking rollers 80 is conventional and functions to provide the first plate cylinder 50 with dampening and inking fluid in a well-known manner.

Associated with and mounted on and fixed to the movable carriage 18 is a second set of conventional dampening and inking rollers 90 located along axes parallel to those of the printer head cylinders. The second set of dampening and inking rollers functions to provide the second plate cylinder 55 with dampening and inking fluids as illustrated.

In a two-color printing operation, the carriage 18 is moved to an engagement position closest to the printer head 16, as illustrated in FIG. 4, wherein the second set of dampening and inking rollers 90 contacts the second plate cylinder 55, as illustrated, via the apertures defined by the carriage and printer head housing edgewalls 40,43 (See FIGS. 2 and 3). The first set of dampening and inking rollers 80 contacts the first plate cylinder 50.

In operation, the plate cylinders 50, 55 each contain, in wraparound fashion, a single-color image-carrying plate which is inked and dampened in a conventional manner by the sets of dampening and inking rollers 80,

90, the directions of cylinder and roller rotation being indicated in FIG. 4. Images from the plate cylinders 50, 55 are simultaneously transferred and superimposed in proper registry upon the blanket cylinder 60. The superimposed images on the blanket cylinder 60 are then simultaneously transferred to the blank printing paper fed between the blanket cylinder 60 and the impression cylinder 65. The printed paper is then stripped from the impression cylinder 65 by the delivery cylinder 70. The movement of the paper between the paper feed input 12 and the paper delivery output 14 defines a sinuous paper handling path extending therebetween, as illustrated in FIG. 4.

The process of printing on paper with two single-color plate cylinders cooperating with a blanket cylinder, which in turn cooperate with respective impression and delivery cylinders, is known in the art, as is a paper handling means generally illustrated in FIG. 4.

In accordance with the invention, the second plate cylinder 55 is rotatably mounted and fixed to the printer head 16, while its associated set of dampening and inking rollers 90 is mounted on and fixed to the movable carriage 18. The carriage 18 is preferably linearly movable to and from the second plate cylinder 55 in a manner to be subsequently explained and lockable at a predetermined number of positions along its travel length by means, of, for example, a detent mechanism 95 or a simple latch mechanism 92.

As illustrated in FIG. 4, the carriage is in an engagement position for a typical two-color offset printing operation as earlier discussed. In accordance with the invention, it can be seen that the detent mechanism 95 as shown in FIG. 4 locks the carriage 18 at the engagement position. The positive locking of the carriage is position by the detent mechanism 95 is accomplished by rotating an eccentrically mounted, vertically extending cam member 96 about a pivot pin 98. Rideable upon the outer upper edge of the cam member 96 is a spring-biased pin 99 which reciprocates to and from the carriage 18 upon a predetermined degree of rotation of the cam member 96. With the cam member 96 in a locking position as illustrated in FIG. 4, the pin 99, slidable upward through a collar 100 fixed relative to the press mainframe, projects into a receiving detent cavity 101 to positively lock the carriage at the illustrated engagement position.

As illustrated in phantom in FIG. 4, the carriage is leftwardly linearly movable back from the illustrated engagement position to a disengagement position 105 which is utilized when the press is operating in a single-color mode. Movement from the illustrated engagement position to the phantom-illustrated disengagement position 105 is accomplished by rotation of the cam member about its pivot pin 98 for approximately 180 degrees from its position illustrated in FIG. 4, causing the pin 99 to move downwardly and drop out of the detent cavity 101, wherein the operator pulls the carriage back away from the printer head 16 to the disengagement position 105, and wherein the cam member 96 is again rotated 180 degrees about the pivot pin 98 to push the pin 99 upward into a disengagement detent cavity 102 for positive locking of the carriage 18.

The carriage is also linearly movable to a further degree away from the printer head 16 to a wash-up position 106 at which the carriage is positively lockable by a mechanism similar to the detent mechanism 95 but not illustrated. It is further noted that the nonoperator side (FIG. 6) of the carriage 18 may include a detent locking mechanism which is opposite but substantially identical to the illustrated detent mechanism 97. The opposed detent mechanism and the illustrated operator side detent mechanism 97 can operate together via a common shaft extending across the carriage from the location of (and in substitution for) the pivot pin 98 to the pivot pin location of the opposed detent mechanism. Such a mechanism permits positive locking of both sides of the carriage 18.

The carriage is further movable to a lock-back position 107 farthest from the printer head 16, wherein positive locking of the carriage in the lock-back position 107 is provided by the pivotally movable latch member 110 mounted to the carriage via a pivot pin 112. As the carriage moves away from the printer head to the lock-back position, the latch member is raised up by a horizontally inclined camming surface 114 for latching engagement with a keeper 115 in the form of a horizontally projecting pin or rod fixed relative to the mainframe in a manner to be explained in more detail.

The rotatable mounting and fixing of the second plate cylinder 55 to the printer head ensures proper alignment between such second plate cylinder 55 and the blanket cylinder 60. The provision of a linearly movable carriage containing the set of dampening and inking rollers 90 which can be withdrawn from the second plate cylinder 55 advantageously permits ready access to the second plate cylinder and to the carriage-mounted dampening and inking rollers for set up procedures and usual maintenance.

Turning to FIGS. 5 and 6, a more detailed illustration of the carriage 18 is presented from the operator's side as shown by FIG. 5 and from the opposed or nonoperator's side shown in FIG. 6. The carriage rides upon a pair of straight parallel rails 120 (FIG. 5) and 122 (FIG. 6) which are supported by and mounted relative to the mainframe of the press. The carriage is movable along the rails 120, 122 between a pair of lock-back, end stop, ringlike collars 125, 126 and the printer head 16 with which the carriage abuts in its engagement position. The collars 125, 126 fit around the rails 120,122 not immediately adjacent to the printer head 16 and are locked to their respective rails 120, 122 by, for example, appropriate setscrews.

The rails are each supported along substantially their entire lengths by an associated pair of L-shaped cross section lengths of angle iron 135, 137 and by generally equal parallel extending lengths of generally-rectangular cross section bar stock 136, 138 positioned between and engaging the angle iron lengths 135, 137 and the respective rails 120, 122. The rails 120, 122, the lengths of bar stock 136, 138, and the lengths of angle iron 135, 137 are rigidly fixed to each other by appropriate fastening means, such as bolts, welds or the like. The lengths of angle iron 135, 137 are in turn rigidly fastened to the press fame. Thus, straight rails 120, 122 rigidly fixed relative to the press frame are parallel to each and extend along and are parallel to an axis normal to the axis of rotation of the second plate cylinder 55 (FIG. 4). The set of dampening and inking rollers 90 have axes of rotation which are normal to the linear motion direction of the carriage and parallel to the axis of rotation of their associated plate cylinder 55.

As illustrated in FIGS. 5 and 6, the carriage 18 having a generally rectangular base area rides the rails 120, 122 on supportive rolling friction bearing means in the form of two pairs of linear motion partial ball bushings 140, 145, each pair riding a respective rail 120, 122. Such

mounting of the carriage structure advantageously provides positive linear motion of the carriage 18 toward the printer head 16 without lateral or skewing movements of the carriage 18 relative to the printer head 16, which could cause misalignment between the set of inking and dampening rollers 90 and the respective second plate cylinder 55.

Turning to FIG. 7, it can be seen that the length of angle iron 135 has a vertically extending leg 131 which is fastened to the press frame by appropriate bolts 132 (only one illustrated). A horizontally extending leg portion 133 of the length of angle iron 135 supports the generally equal length of bar stock 136 which has a generally rectangular cross section (shown more clearly in FIG. 8). The length of bar stock 138, as illustrated in FIG. 7, is held in place against the horizontally extending flange 133 by appropriate bolts 139 (only one shown). The lock-back collar 125 fastened to an end of the rail 120 farthest from the printer head 16 has extending from it in a generally horizontal direction outwardly from the carriage the keeper 115 with which the latch member 110 engages when the carriage is in its lock-back position (FIGS. 4 and 5) as illustrated and earlier discussed with regard to FIG. 4.

Turning to FIG. 8, the mounting of the carriage 18 upon the rails 120, 122 is further illustrated. It can be seen that the ball bushings 140, 145 extend only partially about the circumferential extent of the rods 120, 122. Such linear motion partial ball bushings are further illustrated in FIGS. 9 and 10, where it can be seen that a series of circulating ball bearings move in a line along the longitudinal extent of the rail 20. In FIG. 10 it can be seen that the weight of the carriage is substantially supported only by the lines of recirculating ball bearings so as to provide only rolling friction forces between the carriage and the rail upon which it is movable. Linear motion partial ball bushings of the type illustrated are known in the art and available from Thomson Industries, Inc. of Manhasset, N.Y. With regard to the rail 122 and its related ball bushings 145, it should be noted that their structural relationship to each other is generally identical to the structural relationship between the other rail 120 and ball bushings 140 as discussed with regard to FIGS. 7, 9 and 10.

Turning to FIG. 11, there is illustrated in more detail from the operator's side the printer head 16 which is mounted on and fixed to the mainframe 10 of the press using a plurality of supportive bolts 151. The printer head 16 has rotatably mounted on it the plurality of parallel oriented and generally abutting cylinders in the form of the first plate cylinder 50, the second plate cylinder 55, the blanket cylinder 60, the impression cylinder 65, and the delivery cylinder 70. The rotatable mounting of the second plate cylinder 55 utilizes an eccentric mounting 155 well-known in the art which permits limited translational shifting of the second plate cylinder 155 to and away from the blanket cylinder 60 where, for example, only a single-color operation is required when only the plate cylinder 50 is engaged with the blanket cylinder 60. Such translational shifting of the plate cylinder 55 causes opening and closing of the switch means 37 (FIG. 1) illustrated in FIG. 11 as a microswitch response to press linkage movements associated with the noted translational movement of the plate cyiiinder 55. The utilization of the switch means 37 will be discussed in more detail with regard to the press safety interlock system. The control linkage illustrated in FIG. 11 is of the typical type.

With reference to FIG. 12, there is illustrated in longitudinal across section an operator-accessible mechanism for axially adjusting the second plate cylinder 55 to establish proper superposition or registry of the two-plate cylinder images transferred to the blanket cylinder as explained earlier.

The second plate cylinder 55 is rotatably mounted on and between two opposed and parallel printer head frame members 160, 161. Opposed, cylindrical, aperture-defining walls 162, 163 concentric with a common axis 165, each engagingly receive respective concentric, cylindrical, ringlike bushings 168, 169, which each include respective radially extending flange portions 168a, 169a. The bushings 168, 169 are fixed within the apertures defined by the walls 162,163 to their respective frame members 160, 161 by appropriate screw fasteners 170.

Extending between the bushings 168,169 is a plate cylinder shaft 175 which has a cylindrical midportion 177 having an axis of revolution 178 which is eccentrically set off by a predetermined amount from the axis 165 along which the concentric bushings 168,169 are oriented. The shaft 175 further includes a non-threaded cylindrical end portion 180 received by the bushing 168. The shaft 175 further includes a threaded cylindrical end portion 185 received by the bushing 169. The cylindrical end portions 180,185 lie along their common axes of revolution 165, while the shaft midportion 177 lies along its axis of revolution 178. The two axes 165,178 are parallel to each other wherein the end portions 168,169 of the shaft are eccentric by an equal radial and angular degree relative to the shaft midportion 177. Both of the axes 165,178 are normal to the parallel plane defined by the frame members 160,161 to provide parallel positioning of the second plate cylinder 55 relative to the blanket cylinder 60 (FIG. 11), which is also mounted along an axis normal to the planes defined by the frame members 160,161.

The plate cylinder 55 is rotatably mounted upon reduced end portions 179 (only one shown) of the midportion 177 of the shaft 175. Suitable bearing means, such as tapered roller bearings 181 (only one shown), are utilized at each end of the cylindrical plate cylinder 55 to rotatably mount it on the shaft 175 which is generally not rotatable around the axis 178. The shaft 175 is axially movable to a limited degree between the frame members 160,161 by being axially slidably and rotationally received within the bushings 168,169.

Limited translational movement of the plate cylinder 55 to and from and into and out of engagement with the associated blanket cylinder 60 (see FIG. 11) is provided by rotation of the eccentric end portions 180,185 on the axis 165, such end portion rotation causing the noted translational movement of the shaft midportion 177 and the associated rotationally mounted plate cylinder 55. A suitable linkage 176 (as further illustrated in FIG. 11) is utilized to rotate to a limited degree the shaft end portions 180,185 to provide the noted translational movement of the rotatably mounted cylinder 55. The linkage 176 is fixed to the distal end of the nonthreaded end portion 180 by means of a bolt 190 and shaft key means 191 to limit the degree of rotation of the shaft 175 to substantially less than a full revolution. The use of such eccentric cylinder mountings (Also see element 155, FIG. 11) is well-known in the art, and such mountings can be adapted to any of the cylinders or rollers of the press where such a translational movement function is desirable.

To adjust and maintain the position of the axially movable shaft 175 slidable within the ringlike bushings 168,169, an adjustment mechanism 190 is provided in accordance with the invention. The mechanism 190 includes a spindle 195 having a shaft-engaging end 200 and an operator-accessible distal end 202 which extends through the printer head cover 38 for operator access. The spindle 195 is rotatable on the axis 165, and in a preferred form includes a tube having outer and inner cylindrical walls 194,196. The shaft-engaging end 200 of the spindle 195, which further includes a ringlike collar 197, is threaded on its inner cylindrical wall 198 to engagingly receive the threaded end portion 185 of the shaft 175. While the spindle 195 is rotatable about the axis 165, it is generally not translationally movable along the axis 165. On the other hand, the spindle 175, while axially movable to a limited degree, is in general not rotatable about the axis 178, but for the limited degree of eccentric shaft rotation to cause the earlier-discussed translational movement of the cylinder 55. It can be seen that rotation of the spindle 195, which is generally fixed axially, will cause axial movement of the generally nonrotatable shaft 175. The degree of movement caused by a single revolution or rotation of the spindle 195 depends upon the thread pitch of the threaded end portion 185.

To maintain a set axial position of the shaft 175 and its rotatably mounted plate cylinder 55, a friction biasing means is provided to lock the spindle at a particular rotational location and to substantially limit axial movement of the rotatable spindle 195. In a preferred form, the friction biasing or locking means includes a spindle flange portion 205 extending radially from the shaft-engaging end portion 200 of the spindle 195. The flange portion 205 provides first and second annular friction engaging faces 207, 209 which are concentric with the spindle 195. The first annular face 207 engages with a corresponding annular area of the frame provided, as illustrated, by the bushing flange portion 169*a*. The second annular face 208 frictionally engages with a corresponding opposed annular area provided by a ringlike member 212 which is biased against the second annular face 208 of the flange 205 by appropriate helical spring means 214 extending between the distal ends of studs 216 extending normally from the frame member 161, the studs 216 having lengths substantially in excess of the thick of the flange 205, as illustrated. The studs 216 are equidistantly spaced about the spindle 195 and project through correspondingly equidistant space apertures 211 through the ring member 212. Spring biasing of the ring member 212 against the flange 205 effectively sandwiches the flange between the biased ring member 212 and the bushings 169 to limit axial movement of the rotatable spindle 195. The clutching effect provided between the annular faces 207, 208 and the respective mating annular portions of the bushing 169 and ring member 212 act as an effective means to maintain the axial position of the plate cylinder 55 once it has been set by operator turning of the spindle end 202, which may include a knob 218 fixed thereto. A conventional grease fitting 219 is fixed to the distal end of a hollow rod 220 having its other end 221 threaded into an axial bore (not shown) through the spindle 185, the axial bore communicating with the pair of roller bearings 181. Lubricant is applied under pressure via the grease fitting 219, the hollow rod 220, and the spindle axial bore (not shown) to the roller bearings 181. Also fixed about the rod 220 at its distal end is a ring-like stop member 222 which moves between the distal end of the spindle 195 and the knob 218, as illustrated, to limit the range of axial movement of the plate cylinder 55.

With reference to FIG. 13 and FIG. 1, the earlier-discussed interlock control system for ensuring safe operation of the press of the present invention will now be discussed in further detail. FIG. 13 is a generally schematic diagram of the interlock control system in accordance which the invention with incorporates the earlier noted switching means 19, 21, 23, 30, 32, 37, as geometrically located and as functionally described with regard to FIG. 1. The interlock system includes a conventional pair of power lines 300, 302. Extending across the power lines 300,302 in parallel relation for electrical energization are a press motor 305 and a paper handling vacuum pump 307. Electrically connected between the power lines 300,302, and in series with the press motor 305, is a fuse 306 of the conventional type and a set of normally open relay contacts 304. It can be seen that power will be applied to the press motor 305 when the normally open contacts 304 are closed. In likewise fashion, a set of normally open relay contacts 308 are provided in series with the vacuum pump 307 wherein closing of the contacts 308 applies power to the pump 307, the vacuum pump providing paper to the printer head 16 (FIG. 1) from the paper feed input 12. The operation of the vacuum pump 307 and its utilization in the paper feed input 12 are well-known in the art. Also connected across the power lines 300, 302 are a motor control circuit 320 and a vacuum pump control circuit 340.

The motor control circuit 320 includes, in serial relation and in electrical series relationship between the power lines 300, 302, the paper delivery interlock switch means 19, a carriage/printer head interlock switch means 322 which includes switching means 35, 36, 37, the other paper delivery interlock switch means 21, the printer head movable cover interlock switch means 30, 32, an on-off rocker switch 325, and a motor relay 330.

In operation, the rocker switch 325, having two sets of serially connected contacts 326, 327 and illustrated in its at-rest position, is momentarily switched by the operator to an on condition wherein the set of contacts 327 close. If all of the press interlock switch means (19,322,21,30,32), disregarding switch means 23, are in their proper condition, as will be subsequently explained, power is applied to the press motor relay 330. Upon power actuation to the press motor relay 330, the set of press motor contacts 304 are closed to apply power to the press motor 305. Also closed by the actuation of the relay 330 are a set of latching contacts 328 which parallel and bridge the contacts 327, which, after being momentarily closed by the operator, are returned to the position illustrated such that the contacts 327 are opened and the latching contacts 328 are closed or latched. The relay continues to be powered and to maintain the motor contacts 304 in a closed condition for press motor energization. To turn off the press motor, the operator need only push the rocker switch 325 to its off position wherein the contacts 326 are momentarily open to deenergize the relay 330 and to open the latching contacts 328 and the motor contacts 304. Return of the contacts 326 to their illustrated at-rest, closed position will not affect the deenergized condition of the press, since both sets of contacts 327 and 328 are now open.

The functioning of the various safety interlock switches within the press motor control 320 will now be discussed.

With the press in an on condition, with the relay 330 being energized via the closed latching contacts 328, the press will continue to run unless an unsafe condition is presented in the form of, for example, an open condition of any of the covers 15, 17, 24 or 26, as earlier explained with respect to FIG. 1. The opening of the noted covers during an operating condition of the press would actuate their respective interlock switches 19, 21, 30 or 32 to an open circuit condition. Opening of any of these series of connected interlock switches 19,21,30,32 will deenergize the relay 330 and shut down the press motor 305 due to the opening of contacts 304, as explained earlier. With regard to the series-connected carriage/printer head interlock control 322, the printer head interlock switch means 37 switches between its two illustrated positions as a function of translational movement of the second plate cylinder to (engagement) and away from (disengagement) of the blanket cylinder. The carriage interlock switches 35 and 36, on the other hand, are actuated in accordance with the degree of carriage movement away from the printer head. The switch means 35, 36, 37 cooperate together to limit operator access to the moving plate cylinder when it is turning as a result of engagement with the blanket cylinder and actuation of the press motor 305. With the carriage at its engaged position and with the second plate cylinder engaged with the blanket cylinder, switch 37 is positioned as illustrated in FIG. 13, switching means 36 is closed, and switching means 35 is open. Under these switch conditions, the press motor operates in a normal manner. With the carriage moved to its disengaged position 105 (FIG. 4) the switch means 36 opens and the press motor will not operate until the second plate cylinder is shifted translationally away from and out of engagement with the blanket cylinder. Such shifting of the second plate cylinder throws the switch 37 from the position shown in FIG. 13 to its other position wherein it is in series with switch means 35, which is now closed as a result of carriage movement away from the printer head to the disengagement position. At the wash-up position 106 (FIG. 4) of the carriage, switch means 26 is open and switch means 35 is closed. Press motor actuation for driving of the carriage dampening and inking rollers 80 (FIG. 4) for wash-up purposes can only occur when interlock switch means 37 is in its other position, i.e., when it is actuated by translational movement of the second plate cylinder away from the blanket cylinder so that the cylinder will not rotate, thus exposing the operator to an unsafe position. Finally, when the carriage is moved all the way back to its lock-back position 107, both carriage interlock switch means 35, 36 are in an open circuit condition and the press motor will not operate regardless of the position of the plate cylinder actuated interlock switch means 37. Thus, it can be seen that the press motor interlock switch means 320 provides quick deenergization of the press whenever an unsafe operating condition, as earlier discussed, exists.

Turning to the vacuum pump control circuit 340, a second relay 345 is connected between the power lines 300 and 302 via a series-connected second rocker switch means 346 and the bin overload interlock switch means 23. The rocker switch means 346 functions in the manner similar to that as earlier explained with regard to

rocker switch 325, wherein moving of the rocker switch 346 to an on position energizes the vacuum pump relay 345 and its latching contacts 347, and vacuum pump contacts 308, which in turn energize the vacuum pump 307. When an overload condition within the bin 30 (FIG. 1) is sensed by the interlock switch means 23, opening of interlock switch 23 deenergizes the vacuum pump relay 345, which in turn opens contacts 308 and 347. Reenergization of the vacuum pump motor 307 requires that the operator once again momentarily move the rocker switch 346 to its on condition after the printed paper has been removed from the bin 30 (FIG. 1) to reset the interlock switch means to a closed position.

Although a preferred embodiment of this invention is illustrated, it should be understood that various modifications and rearrangements of parts may be resorted to without departing from the scope of the invention disclosed and claimed herein.

What is claimed is:

1. An offset printing press comprising:

a mainframe including paper handling means, the paper handling means defining a paper handling path extending between a paper feed input and a paper delivery output;

a printer head mounted on and fixed to the mainframe and engageable with the paper handling path at a location generally intermediate the paper feed input and the paper delivery output, the printer head including a single blanket cylinder and a pair of plate cylinders, the plate cylinders being simultaneously engageable with the blanket cylinder, the plate cylinders and blanket cylinder being adjacent to each other and rotatably mounted on the printer head along generally parallel axes, the blanket cylinder being adapted to simultaneously transfer images from the plate cylinders to paper provided by the paper handling means;

a movable carriage mounted on the mainframe and located generally adjacent to the printer head, the carriage being substantially linearly movable along a generally straight line to and from the printer head, the carriage having a rectangular base including four linear motion ball bushings and located at a respective one of the four corners of the rectangular base, the mainframe including a pair of parallel rails upon which the ball bushings ride, the ball bushings engaging the rails to substantially eliminate carriage movement in directions generally perpendicular to the straight line along which the carriage moves, the carriage being positively lockable at predetermined positions along the generally straight line of linear movement;

a first set of dampening and inking rollers rotatably mounted on and fixed to the printer head and engageable with one of the plate cylinders; and

a second set of dampening and inking rollers rotatably mounted on and fixed to the carriage and engageable with the other of the plate cylinders when the carriage is moved toward the printer head to an engagement position.

2. An offset printing press according to claim 1, wherein the rails are circular cross sectional rods supported along substantially their entire lengths by the mainframe.

* * * * *

United States Patent [19]

Butler et al.

[11] **4,270,483**

[45] **Jun. 2, 1981**

[54] **PRINTING COATER**

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[21] Appl. No.: **972,688**

[22] Filed: **Dec. 26, 1978**

[51] **Int. Cl.³** **B05C 11/00**

[52] **U.S. Cl.** **118/46**; 101/217; 118/206; 118/258; 118/262; 118/264; 118/261

[58] **Field of Search** 118/258, 46, 264, 206, 118/261, 262; 101/201, 451, 217

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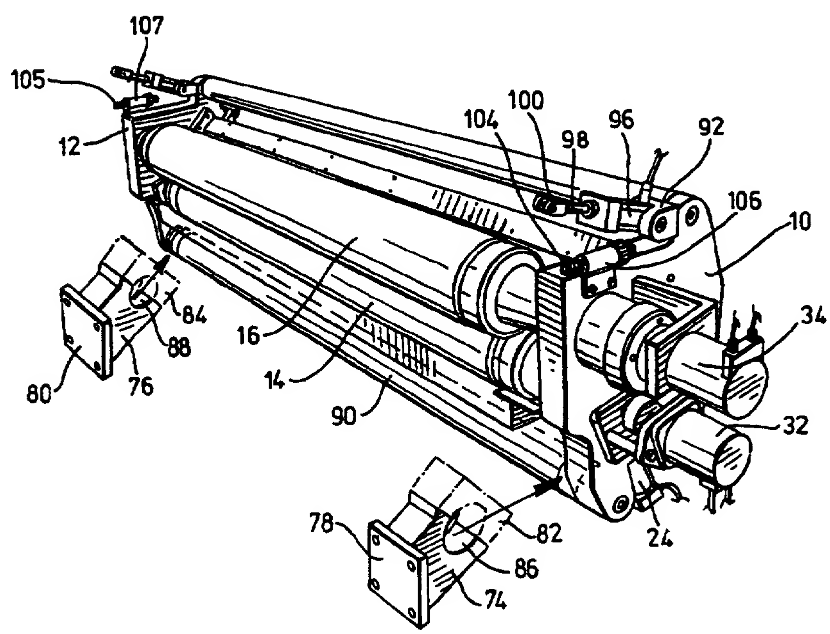
Primary Examiner—Edward C. Kimlin

[57] **ABSTRACT**

An apparatus is provided for attachment to the downstream end of a conventional offset lithographic printing press for in-line coating of the printed work issuing from the press, with water-based polymer coatings, to protect the printing ink as the printed matter sets and hardens. The apparatus includes a pick-up roller which picks up liquid coating composition from a reservoir structure, a cylindrical applicator roller to which the coating composition is transferred, the apparatus being mounted on the frame of the press so that the applicator roller of the apparatus can bear against the blanket roll of the printing press and transfer the coating composition to the blanket roll as the press operates. The apparatus is releasably mounted to the press, and can be pivoted about a lower axis to bring the applicator roll into and out of contact with the blanket roll of the press.

6 Claims, 5 Drawing Figures



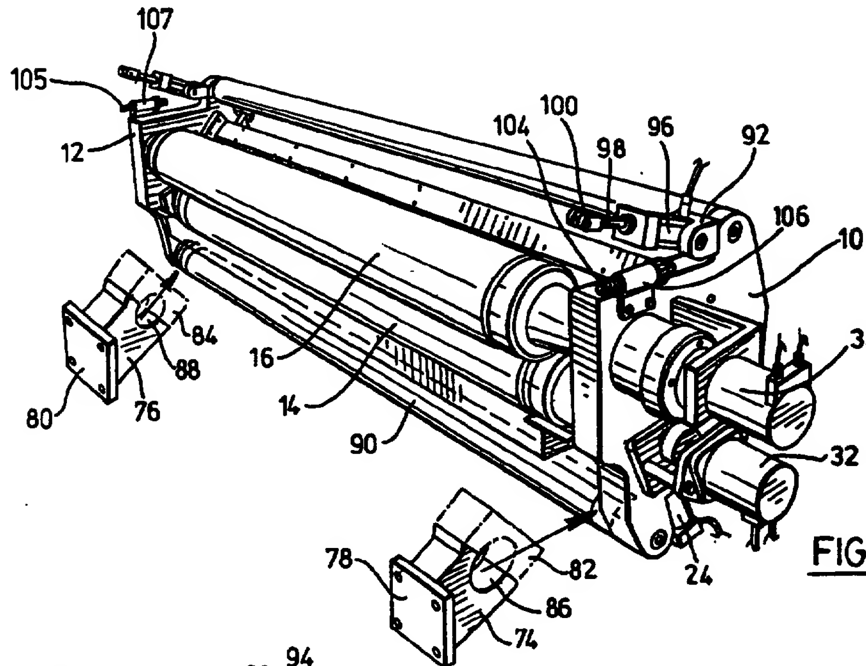

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FIG.1

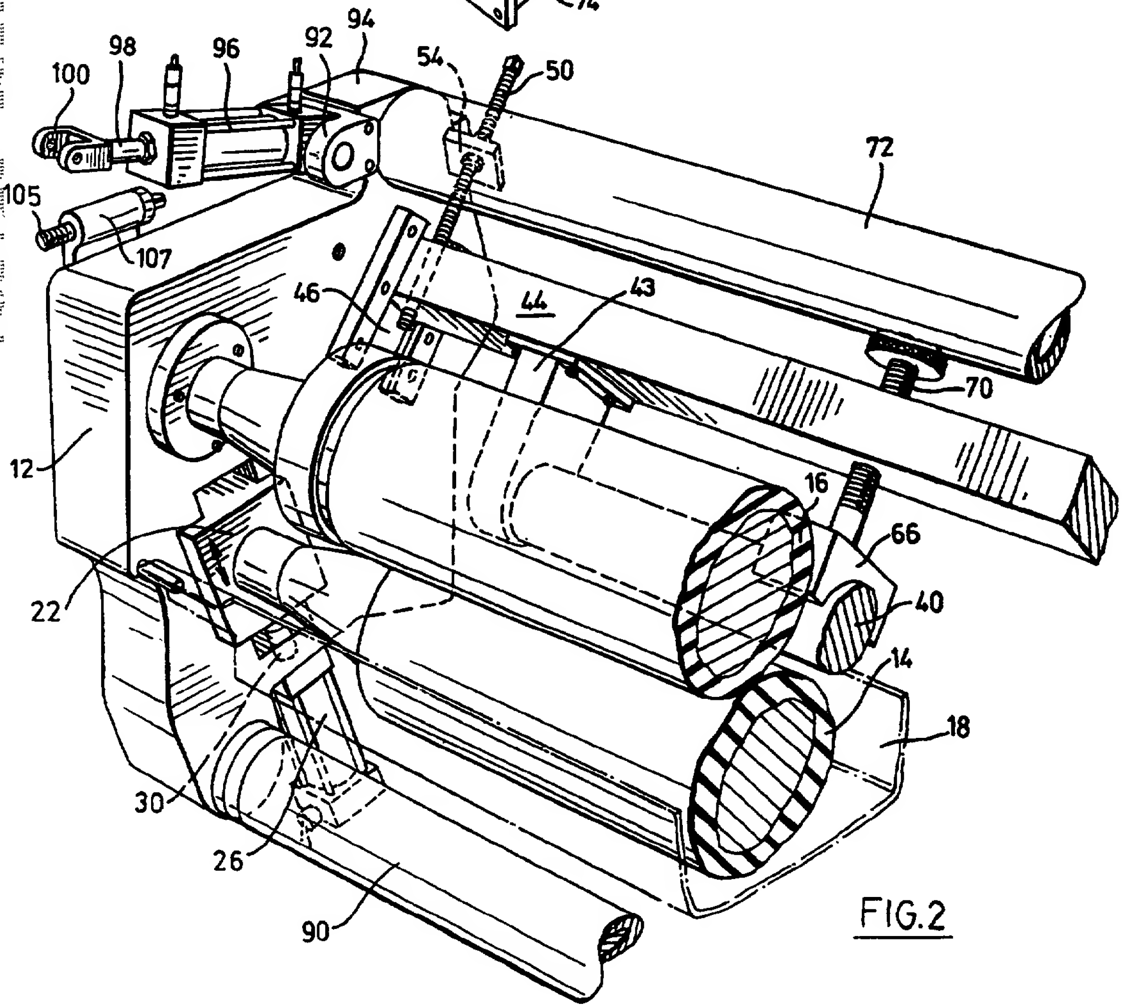
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FIG.2

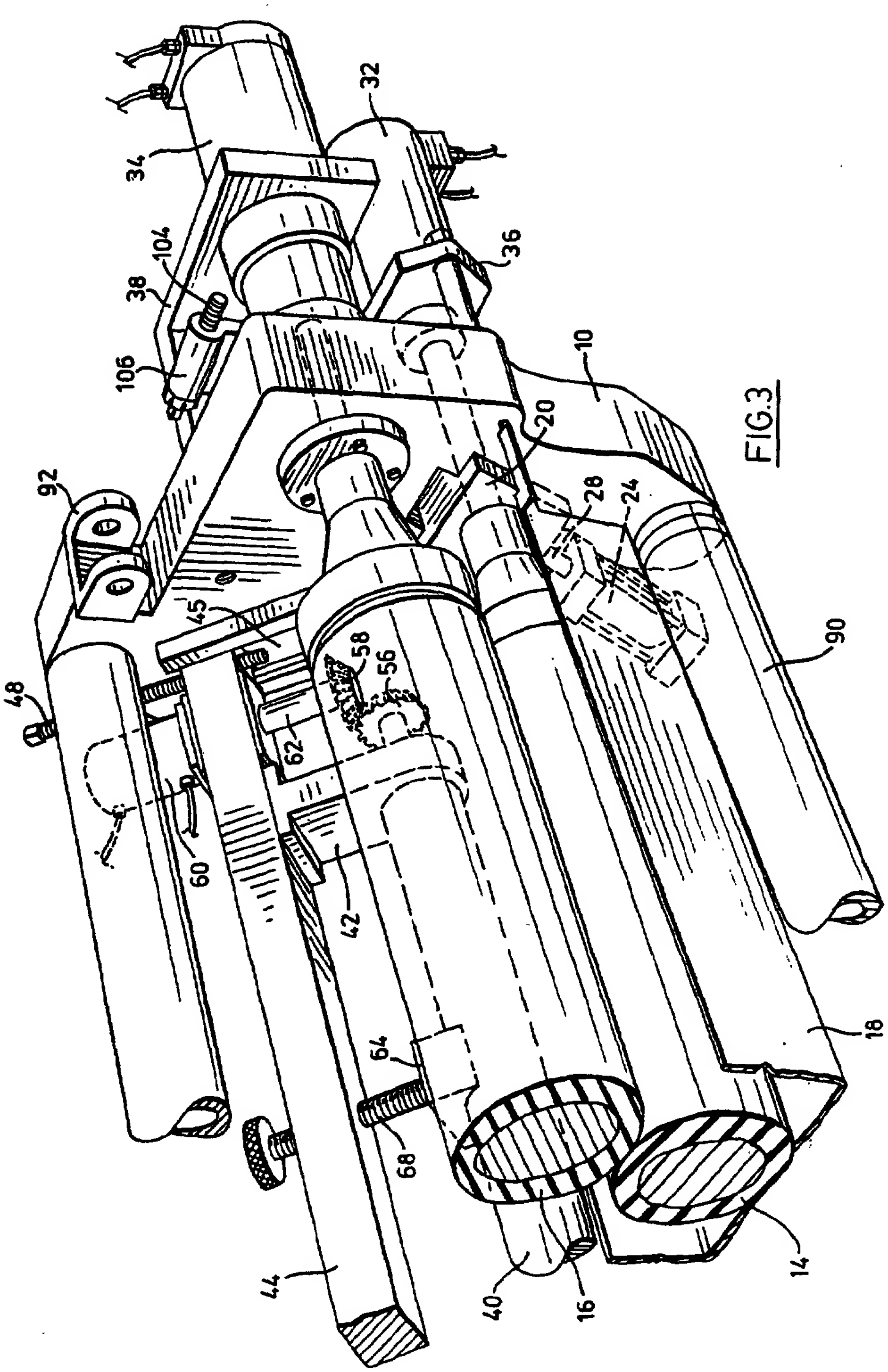

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FIG.3

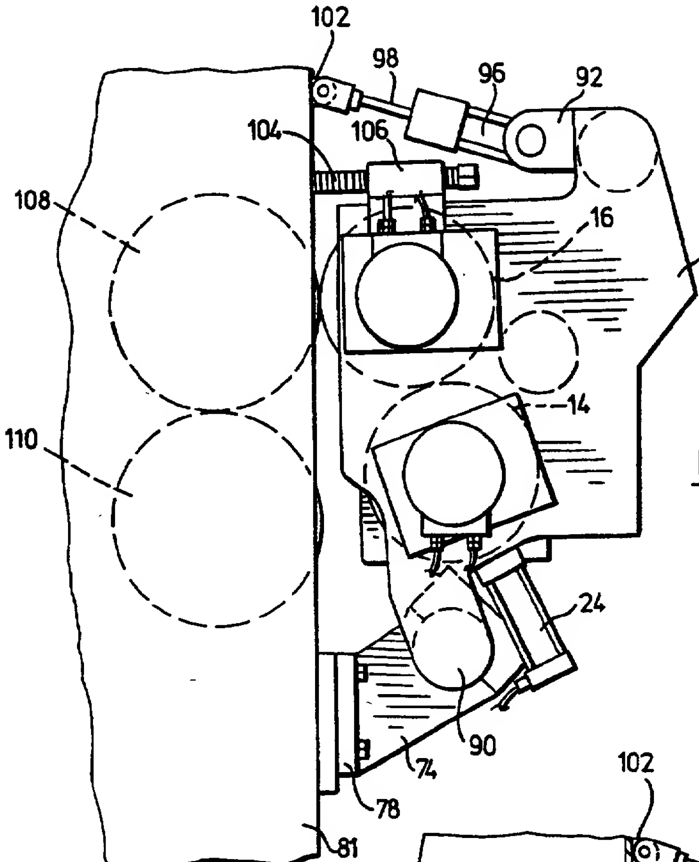
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FIG.4

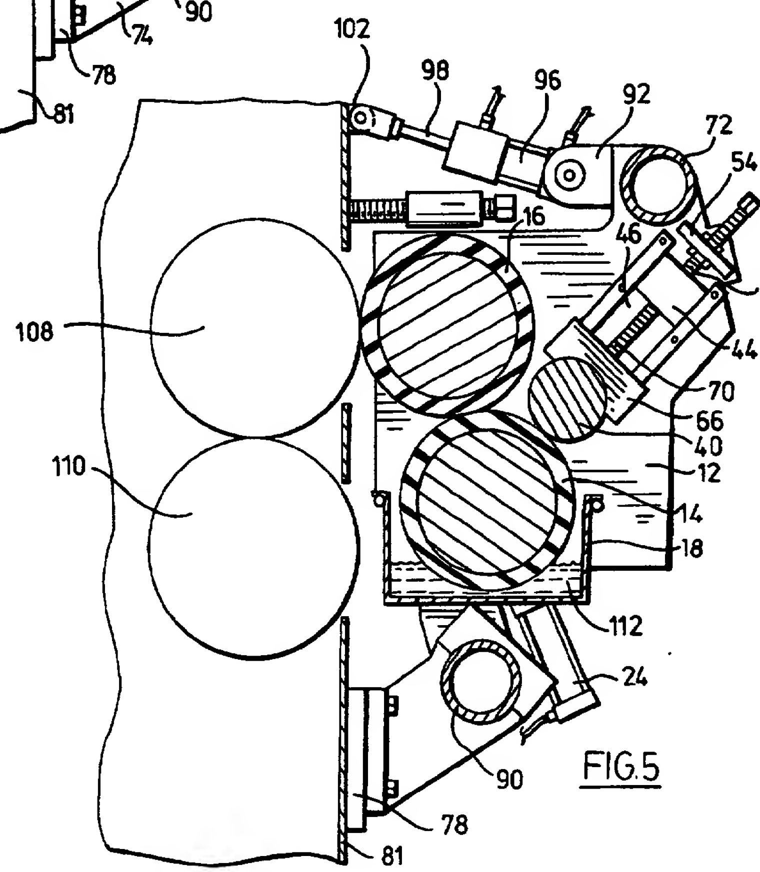
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FIG.5

PRINTING COATER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to offset lithographic printing, and more particularly to apparatus for attachment to the down-stream end of an offset lithographic printing press, for coating purposes.

In offset lithographic printing, each printing stage includes a plate cylinder, to which the printing plates are fastened tightly around the circumference, the plate cylinder being equipped with superimposed inking, watering and wiping mechanisms. The plate cylinder does not come into contact with the paper to be printed, but transfers the image to an intermediate blanket cylinder, which has a specially composed smooth, rubber blanket surface. The blanket cylinder, having received the impression from the plate cylinder, in turn transfers it, or offsets it, onto the paper or other material, whilst it is being carried around an impression cylinder, located out of contact with the plate cylinder. Lithographic inks are oil-based, and special precautions normally need to be taken to dry the inks after their application to the printed material, as rapidly as possible without spoiling the quality of the printing, so that the printed material can be subsequently handled and stacked without damaging the applied printing.

2. Brief Description of the Prior Art

An alternative to conventional drying of printed sheets issuing from a lithographic printing press, is coating of the printed sheet with a water-borne system, to provide either a gloss or dull coating. Water-borne coatings, applied as an aqueous solution or emulsion, are capable of providing a simple protective barrier for the ink, which eliminates the need for the application of spray powder for drying purposes, and protects the ink from abuse whilst its normal setting and oxidation functions proceed. Much development with water soluble polymers has been undertaken in the last few years, to produce acceptable coatings for this purpose. When properly applied, the film is permeable and permits the passage therethrough of oxygen, to permit the normal setting and drying of the ink. In addition to this function of protecting printing inks after application to permit their proper drying, water-borne coatings can perform a useful decorative function to enhance the appearance of high quality, multi-colour printing work, for example phonograph record sleeves.

If the coating of printed material is conducted in a separate operation, after the material has been removed and isolated from the printing press, the operation is expensive and inconvenient, and does not contribute to the solution of the ink drying problems. It is known to apply water-borne and organic solvent lacquers in a separate operation from the printing, to provide special, decorative finishes. The use of solvent based lacquers introduces fire and explosion hazards.

There is a need in the industry for a simple and economical apparatus for application of water-based polymer coatings to printed material immediately after the printing thereof, i.e. in-line coating with the lithographic offset press.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a novel apparatus for inline coating of printed material issuing from an offset lithographic printing press.

It is a further object of the invention to provide such an apparatus which can be releasably secured to an existing offset lithographic printing press, and operated in conjunction therewith without requiring substantial modification of the printing press itself.

The present invention provides an apparatus for application of coatings to printed material, in the form of an attachment to be applied to the downstream end of a conventional offset lithographic printing press. The apparatus is releasably mountable in position so as to apply a liquid coating composition to the blanket cylinder of the final stage of an offset press, the apparatus including an applicator roller which can bear against the surface of the blanket cylinder and rotate therewith, a pick-up roller which applies coating composition to the applicator roller for transfer to the blanket cylinder, and a reservoir of coating composition in which the pick-up roller runs, to obtain its source of coating material. The entire apparatus is constructed as a unit, for application and use with a standard printing press as and when required, and removable therefrom when not in use. It is merely necessary to disconnect the normal liquid supply train associated with the final stage of the press, without even physically removing it from the press, in order to use the apparatus according to the present invention along with a conventional press.

Thus according to one aspect of the present invention, there is provided an in-line coating apparatus for attachment to and use in conjunction with an offset lithographic printing press which has a final stage including a rotatable blanket cylinder and a rotatable impression cylinder, said apparatus being adapted for continuous surface coating of items printed by said press, said coating apparatus comprising:

a reservoir structure for receiving liquid coating compositions;

a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;

a cylindrical applicator roller mounted to rotate with its surface contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller;

drive means for rotatably driving at least one of said pick-up roller and said applicator roller;

releasable mounting means for releasably securing said apparatus to the downstream end of said offset printing press, said mounting means being adapted to secure the apparatus to the press with surface contact between the applicator roller and the final stage blanket cylinder of said press.

From another aspect, the present invention provides an offset lithographic printing press having a plurality of liquid applicator stages, each including a rotatable blanket cylinder and a rotatable impression cylinder, said press including an in-line coating apparatus secured to the down-stream end thereof and operable in conjunction with the blanket cylinder of the final, downstream stage thereof, the coating apparatus including:

a reservoir structure for receiving liquid coating compositions;

a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;

a cylindrical applicator roller mounted to rotate with its surface at one location contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller, said cylindrical applicator roller also mounted to rotate with its surface at the second location contacting the rotating surface of the blanket cylinder of the final stage of the press;

drive means for rotatably driving at least one of said pick-up roller and said applicator roller.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A conventional offset lithographic printing press has at least two stages, and may have four or five stages, when the machine is used for printing several colours. The final stage of such a printing press normally includes a plate cylinder, a blanket cylinder and an impression cylinder, mounted substantially vertically one above the other, with a varnish trough and a train of vertically mounted rollers from the varnish trough downwardly to the plate cylinder, for applying varnish to the printed work as it proceeds out of the printing press. The apparatus according to the present invention is particularly well suited for securing to a printing press of this type. It is then merely necessary to disconnect the roller train between the varnish trough and the plate cylinder, e.g. by removing or displacing one of the rollers of said train, and the apparatus of the present invention can be used in its stead. The apparatus is equally applicable to a final ink-applying stage of an offset press, in similar manner.

Preferably also, the apparatus according to the invention includes a metering roller mounted adjacent to the surface of the pick-up roller, at a location where its surface carries the coating composition to transfer to the applicator roller, so that the metering roller may limit the quantity of coating composition carried by the pick-up roller. It is of advantage also to make the position of the metering roller adjustable, so that the amount of coating applied can be adjusted thereby.

Also according to a preferred embodiment, the apparatus is pivotally mounted with respect to the frame of the printing machine, and is pivotal about a generally horizontal axis located below the level of the blanket cylinder of the press and the pick-up roller of the coating apparatus. Then the apparatus can be pivoted towards and away from the end of the printing press, to put the applicator roller into contact with the blanket cylinder for operating purposes, and to move the applicator roller out of contact with the blanket cylinder, when it is not required to use the coating attachment according to the invention. Such an arrangement greatly enhances the versatility of the resulting printing press, allowing it to be used in conventional manner as well as in application of coating by the apparatus of the invention.

BRIEF REFERENCE TO THE DRAWINGS

FIG. 1 is a perspective view of an in-line coating apparatus according to the present invention;

FIG. 2 is a detailed perspective view of the first, left-hand end of the apparatus of FIG. 1;

FIG. 3 is a detailed perspective view of the second, right-hand end of the apparatus of FIG. 1;

FIG. 4 is an end view of the apparatus of FIG. 1, taken from beyond the left-hand end thereof;

FIG. 5 is a vertical cross-sectional view of the apparatus of FIG. 4.

In the drawings, like reference numerals indicate like parts.

DETAILED DESCRIPTION OF THE SPECIFIC PREFERRED EMBODIMENT

With respect to the drawings, and especially to FIGS. 1, 2 and 3 thereof, an in-line coating apparatus especially for applying water-borne liquid coating compositions to printed sheet or web material, comprises a pair of similar end frame members 10, 12 in which are journalled shafts of the cylindrical pick-up roller 14 and a cylindrical applicator roller 16, mounted above the pick-up roller 14. A reservoir structure in the form of an open-topped trough 18 is provided, in which coating liquid may be contained, and extending between the frame members 10, 12. The pick-up roller 14 is mounted to rotate in the trough 18. The applicator roller 16 and the pick-up roller 14 have surface contact near the top of the pick-up roller 14. The position of pick-up roller 14 is adjustable to a limited extent, towards and away from the applicator roller 16 and relative to the bottom of the trough 18, by slidable journal blocks 20, 22 slidably mounted in apertures in respective end frame members 10, 12. The journal blocks 20, 22 are positionally adjustable in end frame members 10, 12 by means of respective hydraulic cylinders 24, 26 with pistons 28, 30 protruding upwardly therefrom and passing upwardly through apertures in frame members 10, 12 to bear against the underside of the journal blocks 20, 22. The cylinders 24, 26 are connected to a suitable source of hydraulic power, not shown.

The shafts of the pick-up roller 14 and applicator roller 16 are each provided with respective hydraulic motors 32, 34, for rotational drive of the rollers. The motors 32, 34 are mounted in respective structural brackets 36, 38 protruding axially beyond side frame member 10 and secured thereto.

A cylindrical rotatable metering rod 40 is provided, extending parallel to the pick-up roller 14 and applicator roller 16, and rotatably mounted in bearing blocks 42, 43 one at each end of metering rod 40. The bearing blocks are securely bolted to a mounting bar 44 which at each end is slidably received in slideways 45, 46 on the inner surfaces of respective end frame members 10, 12. The slideways are directed radially towards the pick-up roller 14 so that the proximity of metering rod 40 to pick-up roller 14 is adjustable by adjusting the position of mounting bar 44 in slideways 45, 46. To effect this adjustment, screw shafts 48, 50 are provided, threadably engaging brackets such as 54, on respective end frame members 10, 12, and received in mounting bar 44. Metering rod 40 is driven for rotation by means of bevel gears 56, 58 and hydraulic motor 60 with drive shaft 62, mounted on mounting bar 44. The metering rod 40 is steadied and guided in its rotation by adjustable guide blocks 64, 66, the end, part cylindrical surface of which slidably engages the circumference of rod 40. The guide blocks 64, 66 ensure an even coating thickness across the width of the press. They serve to minimize coating thickness variance caused by roller sag along its considerable length, or deflection thereof due to mechanical problems. The guide blocks 64, 66 are mounted on the end of respective screw threaded bolts 68, 70 threadably received in apertures in mount-

ing bar 44. Above the mounting bar 44, there is provided a tubular strengthening rail 72 extending between end frame members 10, 12.

The mounting means for releasably securing the coating apparatus to the downstream end of an offset printing press comprises a pair of similar clamps 74, 76 each provided with a plate 78, 80 to be bolted to upright end frames 81 of a printing press (FIGS. 4 and 5). Each clamp 74, 76 has a respective removable block 82, 84 defining a circular aperture 86, 88. There is provided a cylindrical mounting rod 90 on the apparatus, extending between the end frame members 10, 12 at the lowermost part thereof. The mounting rod 90 is received in circular apertures 86, 88 in the clamps to form a pivotal connection of the apparatus to the press at this lowermost part.

At its upper part, the apparatus is connected to the press by means of a pair of length adjustable linkages, one attached to each end of frame member 10, 12. Each linkage comprises a yoke 92 secured to an uppermost protrusion 94 on the respective end frame member 10, 12 (see especially FIG. 2), the yoke 92 having pivotally secured thereto a hydraulic cylinder 96 and piston 98, the end of piston 98 having a bifurcated formation 100 for pivotal securing to a bracket 102 on the end frame 81 of the press. Thus hydraulic cylinder 96 can be pressurized to extend piston 98 and cause pivoting of the coating apparatus relative to the frame 81 of the press, about the inner horizontal axis provided by the mounting rod 90. The forwardmost position of the pivoting movement of the apparatus towards the press frame 81 is limited, to an adjustable extent, by a stop means comprising a pair of bolts 104, 105 threadably received in respective threaded sleeve mounts 106, 107, one at each end frame member 10, 12 at the top surface thereof, the bolts 104, 105 protruding axially towards the end frame 81 of the press.

The mounting and operation of the apparatus of the present invention will be apparent from the foregoing description and particularly with reference to FIGS. 4 and 5 of the accompanying drawings. The apparatus is mounted in position on the end frame 81 of an offset lithographic printing press, the final, downstream stage of which includes a blanket cylinder 108 and impression cylinder 110, between which printed material is fed. The mounting is accomplished using releasable clamps 74, 76 pivotally engaging mounting rod 90, and by connecting bifurcated formations 100 on piston rods 98 to brackets 102. Coating liquid 112 is introduced into trough 18. The relative position of pick-up roller 14, applicator roller 16 and metering rod 40 are adjusted to provide the pick-up and transfer of coating liquid 12 in the desired amount. Hydraulic cylinders 96 are contracted to pivot the apparatus about rod 90 and bring applicator roller 16 into light surface contact with blanket cylinder 108 of the press. The contact pressure is limited by presetting the position of stop bolts 104, 105 in their respective sleeves 106, 107, to engage the end frame 81 of the press at the desired position. This prevents undue pressure on and consequent damage to the surface of the blanket cylinder 108. The various drive motors for the apparatus are activated to drive the rollers etc. at the desired speed to match that of the press. Coating liquid 112 is picked up from trough 18 by pick-up roller 14, metered by rod 40, transferred to applicator roll 16 by surface contact therewith, and thence similarly to the blanket cylinder 108 of the press to coat sheets printed by and issuing from the downstream end of the press. When it is desired to interrupt the application of coating, the hydraulic cylinders 96 may be pressurized to pivot the apparatus about rod 90, clockwise with reference to FIGS. 4 and 5, and bring applicator roller 16 out of surface contact with blanket cylinder 108. The printing press conventionally has a liquid trough and train of smooth surface transfer rollers located above the blanket cylinder and plate cylinder (not shown) thereof, for supply of other liquids such as varnishes to the printed sheet via the blanket cylinder. When the apparatus according to the invention is moved to its operative position shown in FIGS. 4 and 5, the conventional liquid application is rendered inoperative by interrupting the liquid supply roller train thereof. The conventional system can readily be replaced and used when the apparatus of the invention is not to be employed and is pivoted to its inoperative position or removed entirely from the press.

The apparatus according to the present invention thus provides a simple and versatile in-line coating means for use with conventional, standard offset lithographic printing presses. It is well suited for the application of water-based polymer coatings to newly printed work, to protect the ink thereon whilst it sets and hardens. It requires a minimum of modifications to the standard press and easily installed as an "add-on" item. It does not interfere with sheet feed and collection apparatus of the press, and can be used with conventional dryers if desired. Once installed it can be moved to an inoperative position simply and easily without total removal from the press if desired, and the press restored to its full conventional operation.

Whilst a specific preferred embodiment of an apparatus according to the invention has been described and illustrated in detail herein, it will be appreciated that this is for illustrative purposes only and is not to be construed as limiting. Many variations of standard parts, e.g. use of alternative drive means and power actuation means, will readily occur to those skilled in the art. The scope of the invention is defined by the appended claims.

What we claim is:

1. An in-line coating apparatus for attachment to and use in conjunction with an offset lithographic printing press which has a final printing stage including plate, blanket and impression cylinders, said blanket cylinder engaging with said impression cylinder to print a sheet passing between the blanket and impression cylinders, said apparatus being adapted for continuous surface coating of items printed by said press and passing in contact with said blanket cylinder of the final printing stage thereof, the coating apparatus comprising:

- a reservoir structure for receiving liquid coating compositions;
- a cylindrical pick-up roller adapted to receive on its surface coating composition from said reservoir structure as it rotates;
- a cylindrical applicator roller mounted to rotate with its surface contacting the rotating surface of said pick-up roller so as to transfer liquid coating composition from the pick-up roller to the applicator roller;
- drive means for rotatably driving at least one of said pick-up roller and said applicator roller;
- releasable mounting means to mount said apparatus adjacent the blanket cylinder of said final printing stage of said printing press, said mounting means being effective to secure the apparatus to the press

and including control means for moving the applicator roll independently of said blanket cylinder so that the blanket cylinder remains in engagement with said impression cylinder, between a first, operative position in which said applicator roll is in engagement with the blanket cylinder of the final printing stage of said press and a second, inoperative position in which said applicator roll is disengaged from said blanket cylinder, said control means constituting means permitting said final stage optionally to be used as a printing stage and as a coating stage.

2. The apparatus of claim 1 further including a metering roller mounted adjacent to the surface of the pick-up roller at a location where said surface carries coating composition to transfer to the applicator roller, said metering roller being adapted to limit the quantity of coating composition carried by the pick-up roller.

3. The apparatus of claim 2 wherein the metering roller is positionally adjustable, towards and away from the pick-up roller.

4. The apparatus of claim 3 including adjustment means for adjusting the relative positions of the pick-up roller and the applicator roller, to vary the surface contact pressure therebetween.

5. The apparatus of claim 1 wherein the releasable mounting means is a pivotal mounting means comprising a lower pivot mount for releasably attaching to a lower part of the frame of the printing press, said lower pivot mount being disposed below the pick-up roller and applicator roller, and an upper mount for releasable attachment to a higher part of the frame of the printing press, said upper mount being disposed above the applicator roller and comprising a length adjustable linkage, the length of said linkage being adjustable in a direction towards and away from the end of the printing press to cause pivoting of the apparatus relative to the printing press about said lower pivot mount, thereby bringing the applicator roller into and out of operative contact with the blanket cylinder of said printing press.

6. The apparatus of claim 5 also including an adjustable stop means mounted on the upper part thereof, adapted to engage the end frame of the printing press to limit the pivoting movement of the apparatus towards the end of the printing press when the applicator roller is brought into contact with the blanket cylinder.

* * * * *

31

United States Patent [19]

Rebel

[11] **4,372,244**

[45] **Feb. 8, 1983**

[54] **VARNISHING UNITS ON PRINTING PRESSES**

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[73] Assignee: **M.A.N.-ROLAND Druckmaschinen Aktiengesellschaft**, Fed. Rep. of Germany

[21] Appl. No.: **328,531**

[22] Filed: **Dec. 8, 1981**

[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**³ **B05C 1/16**

[52] **U.S. Cl.** **118/46**; 118/222; 118/262

[58] **Field of Search** 118/204, 221, 222, 262, 118/46

[56] **References Cited**

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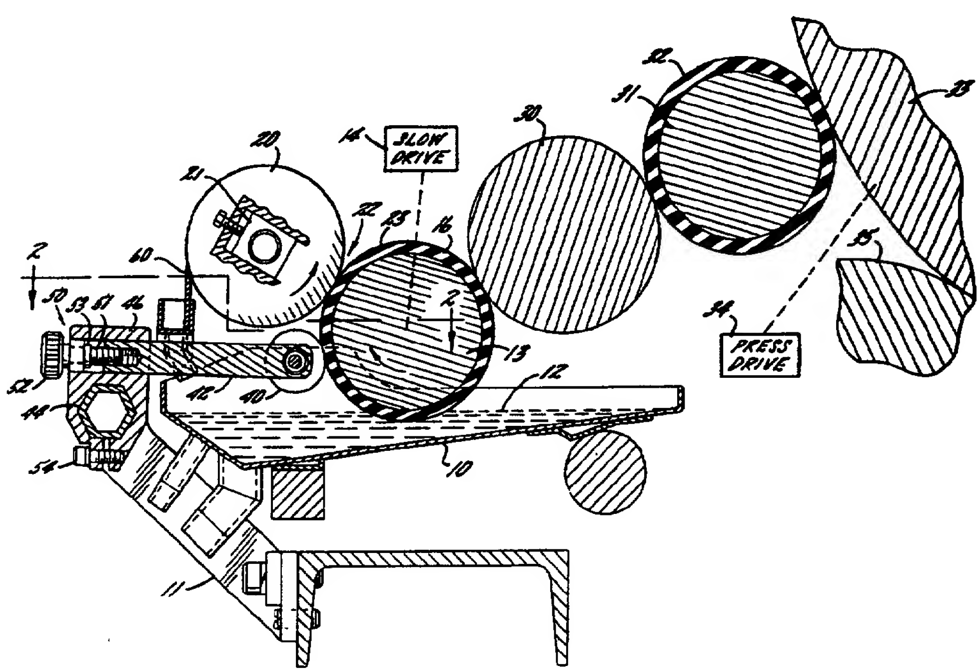
Primary Examiner—Evan K. Lawrence

Attorney, Agent, or Firm—Leydig, Voit, Osann, Mayer & Holt, Ltd.

[57] **ABSTRACT**

A varnishing unit for applying varnish in a strip of selected width on a sheet carried on the impression cylinder of a printing press distinguished by use of a plurality of adjustable varnish blocking rollers arranged adjacent a fountain roller between a varnish trough and a metering nip formed between a metering roller and the fountain roller. The blocking rollers are hard surfaced and of relatively small diameter, and are secured to the frame by arms located at the respective ends of each roller. Each blocking roller is individually adjustable between (a) a position in which it forcibly indents the surface of the fountain roller so as to substantially cut off the flow of varnish to the metering nip, in the region of width controlled by the blocking roller and (b) a position withdrawn from the surface of the fountain roller to permit passage of a strip of varnish in the controlled region to the metering nip and thence via intermediate rollers to the varnishing cylinder. The arms can be differentially adjusted so that the flow of varnish may be blocked off at one end of the roller but not at the other to achieve a varnish strip of a width which is less than the length of the blocking roller. Furthermore, the arms on which the blocking rollers are mounted are slidable on a cross beam which extends parallel to the fountain roller to permit adjustment of the position of the region controlled by the blocking roller.

4 Claims, 5 Drawing Figures



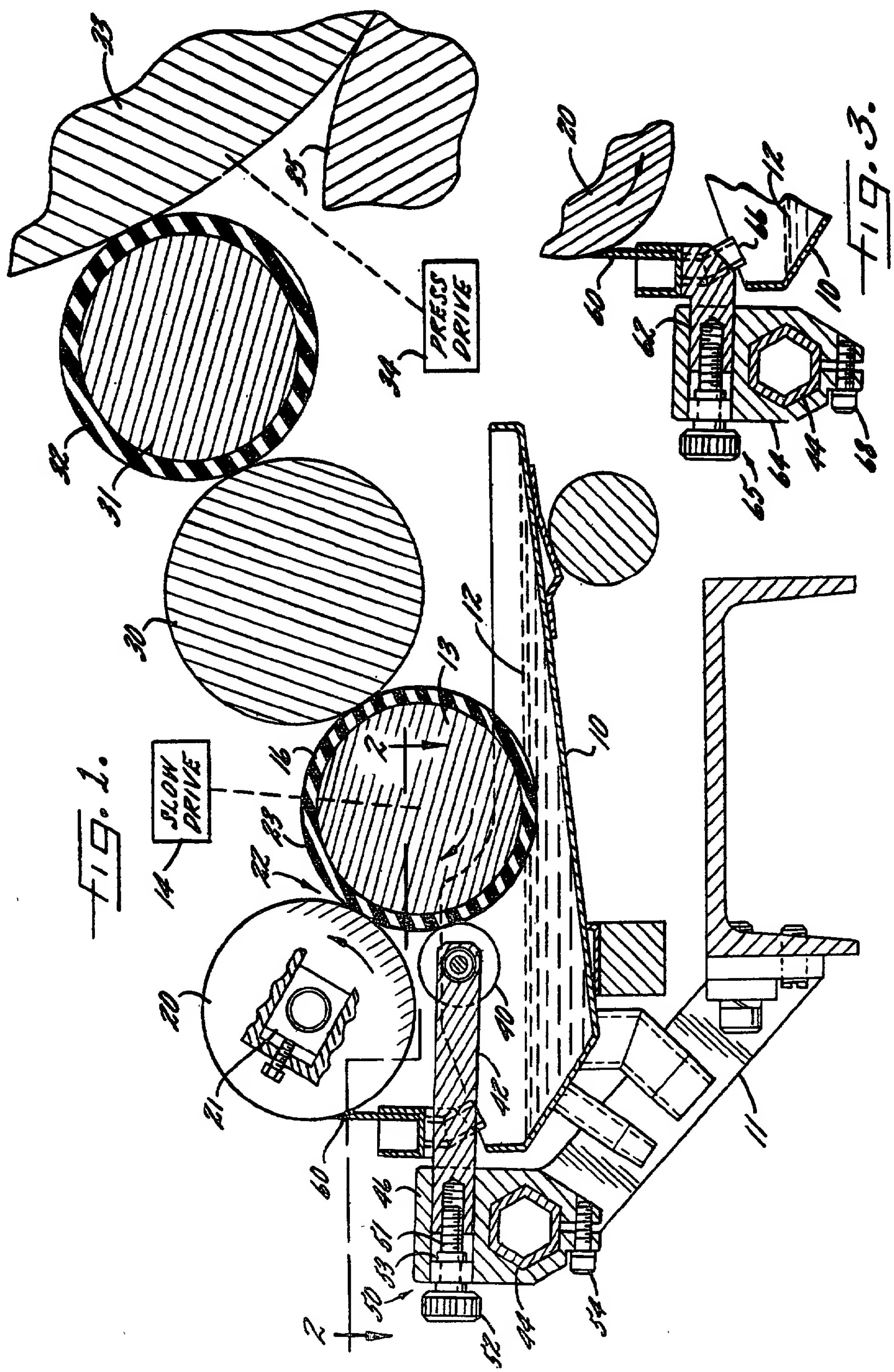


Fig. 1.

Fig. 3.

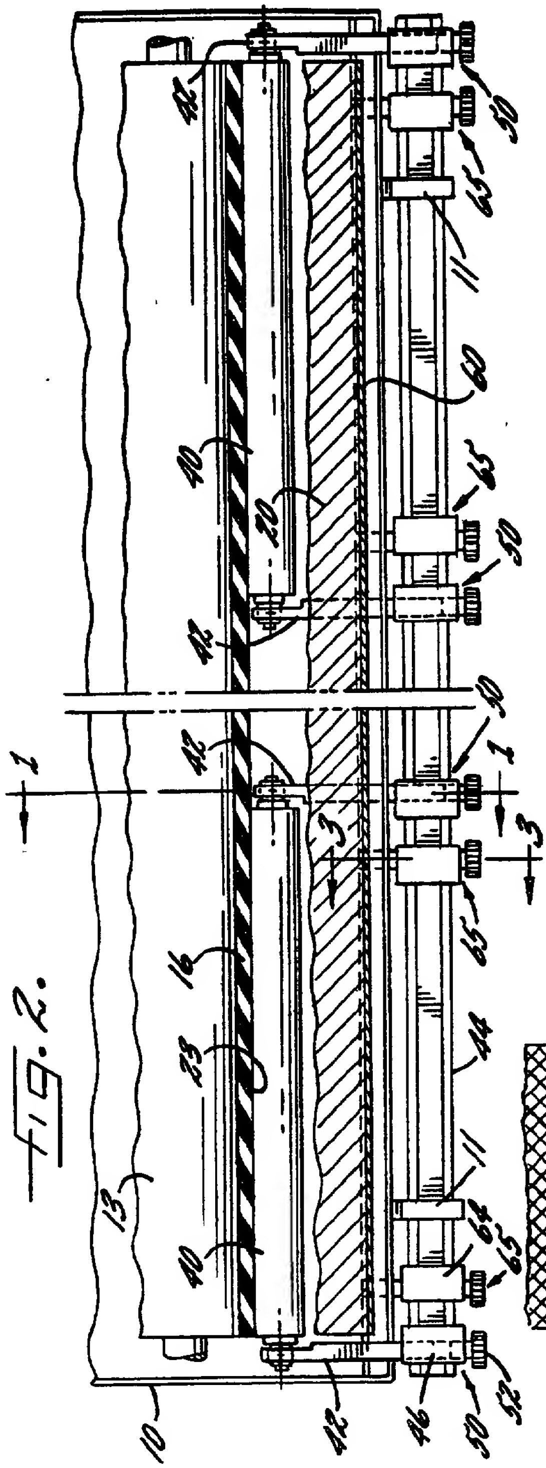


Fig. 2.

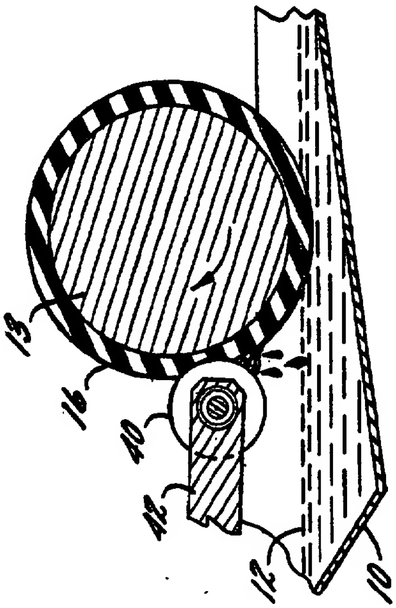


Fig. 5.

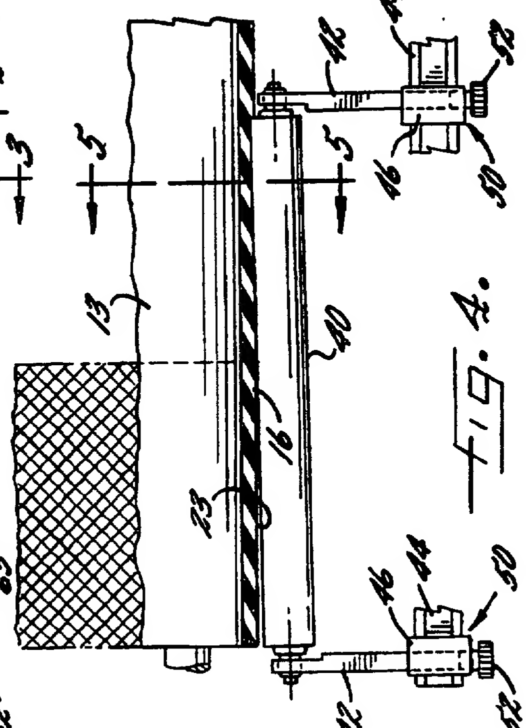


Fig. 4.

VARNISHING UNITS ON PRINTING PRESSES

When printing pages requiring a glossy finish, as is common in many of today's magazines and catalogues, a varnish must be applied to the printed sheet to provide the gloss. As is well known in the art, varnish is transferred through a series of rollers to a varnishing cylinder, which rollingly engages an impression cylinder to transfer the varnish to the printed matter carried by the impression cylinder. However, a problem has arisen when sheets of various size are sought to be varnished. There has not been a satisfactory way to use a single varnishing unit to apply varnish to sheets of different width, or to apply varnish in a strip of a desired width and location on a sheet.

It is, accordingly, an object of the present invention to provide a varnishing unit for a printing press which can be used to apply varnish to printed sheets of various width or in a strip of desired width and location. It is a related object to provide a varnishing unit in which the working areas of the rollers which transfer the varnish to the varnishing cylinder can be quickly and easily adjusted. A further object lies in the provision of an adjustable width varnishing unit which is both economical and simple to make and operate.

More specifically, it is an object of the present invention to provide blocking rollers which are adjustable both endwise and in skewed engagement with a fountain roller to selectively control the working areas of the fountain roller, its metering roller, and other rollers which carry the varnish eventually transferred to the varnishing cylinder for application to the printed matter.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a vertical cross-sectional view taken generally along line 1—1 in FIG. 2 showing a varnishing unit embodying the present invention;

FIG. 2 is a plan view in partial section taken generally along line 1—1 in FIG. 1;

FIG. 3 is a fragmentary section taken along line 3—3 of FIG. 2 showing a scraper blade forming part of the present invention;

FIG. 4 is a partial plan view, similar to the view in FIG. 2, showing a blocking roller adjusted to permit varnish to be transmitted only over a narrow width on the fountain roller; and

FIG. 5 is a fragmentary section taken along line 5—5 in FIG. 4 showing the blocking effect of the blocking roller.

While the invention will be described in connection with a preferred embodiment, it will be understood that there is no intention to limit the invention to the construction shown but, on the contrary, but it is intended to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1, there is shown a typical varnishing unit having a trough 10, supported by a frame 11, for holding the varnish supply 12, and a fountain roller 13 which is partially immersed in the varnish supply so that, upon rotation of the fountain roller 13 by a slowly rotating driving means 14, the entire submerged length of the fountain roller 13 will be coated with varnish. The fountain roller 13 is provided with a resilient surface layer 16 and is rollingly engaged by a hard-surfaced metering roller 20 to form a metering nip 22. The metering roller 20 includes means 21 for adjusting the degree of indentation of the metering roller upon the fountain roller. The degree of this indentation determines the thickness of the film of varnish 23 which will cling to the fountain roller 13 on the downstream side of the metering nip 22.

Downstream of the metering nip 22, the fountain roller 13 is engaged by a hard-surfaced distributor roller 30. The distributor roller 30 accepts the film of varnish from the fountain roller 13 and in turn transfers the film to a form roller 31 having a resilient surface layer 32, which is mounted for rolling engagement with the distributor roller 30. The form roller 31 in turn transfers the film of varnish to a varnishing cylinder 33, which is driven by a press drive 34. The varnishing cylinder 33 is arranged for engagement with a sheet of printed matter (not shown) carried on a conventional impression cylinder 35, shown symbolically, so that the film of varnish carried by the varnishing cylinder 33 is applied to the sheet. Slippage occurs between rollers 13 and 30.

In carrying out the present invention, a plurality of varnish blocking rollers 40 are arranged adjacent the fountain roller 13 between the varnish trough 10 and the metering nip 22 when viewed in the direction of rotation of the fountain roller. The blocking rollers 40 are hard surfaced and of relatively small diameter in comparison with the fountain roller 13. The blocking rollers 40 are mounted to the frame 11 and have adjusting means for individual adjustment of each blocking roller between (a) a position in which the blocking roller forcibly indents the resilient surface of the fountain roller to substantially cut off the flow of varnish to the metering nip 22 in the indented region of the fountain roller, and (b) a position in which the blocking roller 40 is withdrawn from engagement with the fountain roller 13 to permit a passage of a film of varnish on the section of the fountain roller which is potentially engageable with the blocking roller 40. This film of varnish travels through the metering nip 22 and is eventually transferred to the varnishing cylinder 33 for application to the sheet on the impression cylinder 35. Thus, each blocking roller 40 defines a controlled region of width on the fountain roller for the transmission of varnish.

More specifically, each blocking roller 40 is journaled at its respective ends by a pair of arms 42. These arms 42 are secured to a cross beam 44 through brackets 46, the cross beam 44 being secured to the frame 11 and extending parallel to the fountain roller 13. Each bracket 46 mounts an arm adjusting mechanism 50 which includes a threaded screw 51 having a knob 52 and a collar 53. The threaded screw 51 engages the internal threads of a bore in each arm 42, while the collar holds the screw captive in the bracket. By rotating the knob 52, and thus either screwing the thread 51 into or out of the threaded bore in the arm 42, the blocking roller can be either moved into engagement with, or away from, the fountain roller 13. As shown in FIG. 5, the arms may be adjusted so that the blocking roller 40 forcibly indents the surface of the fountain roller 13 so that the flow of varnish is substantially completely blocked off, with the intercepted varnish simply dripping back into the trough.

Because no varnish will be carried on the resilient surface 16 of the fountain roller 13 which is indentedly engaged by a blocking roller 40, the region or zone of the fountain roller 13 which does not transmit a film of

varnish can be varied by selective engagement of a blocking roller. Thus, the width of the film of varnish, and the active regions of the rollers over which it is transmitted, can be adjusted so that a film of varnish is applied to only a selected portion of the varnishing cylinder 33.

Also in keeping with the present invention, each bracket 46 is clamped to the cross beam 44 with a screw 54. With these clamping screws 54 loosened, the brackets 46 and their corresponding arms 42 can be shifted along the cross beam 44 to achieve endwise adjustment of each blocking roller, thus permitting endwise adjustment of the position of the region controlled by the blocking roller for control of the flow of varnish to the surface of the varnishing cylinder. The present device thus permits a strip of varnish of selected widtih to be carried at a selected position on the fountain roller for eventual transmission to the impression cylinder of a printing press.

In practicing the invention, a scraper blade 60 engages the metering roller 20 on the downstream side of the nip 22 to scrape off varnish which clings to the metering roller 20, returning it to the trough 10. The scraper blade 60 allows the metering roller 20 to act on the fountain roller 13 without affecting the varnish-free areas of the fountain roller, as any residual varnish has been substantially removed from the metering roller. As best seen in FIG. 3, the resilient scraper blade 60 is held by arms 62, which are in turn held in adjustable brackets 64 mounted on the cross beam 44. The arms 62 are mounted for movement within the bracket 64 in an adjusting device 65 similar to that disclosed at 50 with respect to the arms which hold the blocking rollers. The adjustability of the radial position of the scraper blade permits the blade to be moved in concert with the metering roller 20, as the metering roller is moved to vary the degree of its indentation upon the fountain roller, which varies the quantity of varnish carried by the fountain roller.

The scraper blade 60 transmits the varnish scraped off the metering roller 20 back into the varnish trough 10 through a return channel 66, which is held by the arms 62. Similarly to the brackets 46 disclosed in conjunction with the blocking rollers, brackets 64 are also slidable along the length of the cross beam 44. Each bracket 64 has a clamping screw 68 which, when a desired position of the slidable bracket 64 is reached, can be tightened to securely hold the scraper blade in its desired position. A single scraper blade which extends over the full length of the metering roller is preferred, although multiple scraper blades may be employed if desired, one corresponding to each blocking roller. The removal of the excess varnish on the metering roller by the scraper blade insures that no varnish can be recirculated on the on the metering roller back to the metering nip.

In keeping with the invention, each arm adjusting mechanism 50 can be independently manipulated so that one end of its corresponding blocking roller 40 forcibly indents the surface of the fountain roller 13 to block off, at that end, the flow of varnish to the metering nip 22, while the other end of the blocking roller is withdrawn from the fountain roller 13 by its arm adjusting mechanism 50. This is best shown in FIG. 4 and allows for a strip of varnish of a width less than the length of the blocking roller 40 (indicated by the cross-hatching in FIG. 4) to be transferred by the fountain roller 13 to, eventually, the varnishing cylinder 33 for application to a sheet on the impression cylinder 35. Thus, by selectively adjusting the portion of a blocking roller 40 which engages the fountain roller 13, the varnish strip which is carried by the fountain roller can be varied to any length less than the length of the blocking roller.

It will be apparent that the objects of the invention have been amply fulfilled. The blocking rollers 40 mounted on slidable adjustable arms 42 and brackets 46 permit a strip of varnish of a selected width to be carried by a selected region of the fountain roller for application to a sheet of printed material carried by the impression cylinder.

I claim:

1. A varnishing unit for applying varnish in a strip of selected width on a sheet carried on the impression cylinder of a printing press comprising, in combination, a frame, a varnishing cylinder arranged for engagement with the sheet on the impression cylinder, a varnish trough, a resiliently surfaced fountain roller, driving means for slowly rotating the fountain roller in the varnish in the trough, a hard surfaced metering roller in rolling engagement with the fountain roller to form a metering nip, means for adjusting the degree of indentation of the metering roller upon the fountain roller thereby to determine the thickness of the film of varnish which clings to the fountain roller on the downstream side of the nip, a scraper blade on the metering roller on the downstream side of the nip for scraping off the varnish which clings to the metering roller for return thereof to the trough, a hard surfaced distributor roller in engagement with the fountain roller downstream of the nip for accepting the film of varnish, a resilient form roller in rolling engagement with the distributor roller for transferring the film to the varnishing cylinder, and a plurality of varnish blocking rollers arranged adjacent the fountain roller between the trough and the metering nip, the blocking rollers being hard-surfaced and of relatively small diameter, means including arms at the respective ends of each roller and secured to the frame for supporting the blocking rollers end to end so that each defines a region of width on the fountain roller for control of varnish flow, the arms having adjusting means for individual adjustment of each blocking roller between (a) a forcibly indented position on the surface of the fountain roller sufficient to substantially cut off the flow of varnish to the metering nip in the region of width controlled by the blocking roller and (b) a withdrawn position permitting passage of a strip of varnish in the controlled region to the metering nip and thence to the varnishing cylinder, the adjusting means at each end of a blocking roller being differentially adjustable so that flow of varnish may be blocked off at one end of the blocking roller but not at the other thereby to achieve a varnish strip of a width which is less than the length of the blocking roller.

2. The combination as claimed in claim 1 in which the frame of the press has a cross beam extending parallel to the fountain roller, the supporting arms being slidably mounted on the cross beam to achieve endwise adjustment of each blocking roller thereby to adjust the position of the region controlled by the blocking roller for control of flow of varnish to the surface of the varnishing cylinder.

3. The combination as claimed in claim 1 in which the scraper blade extends over the full length of the metering roller.

4. The combination as claimed in claim 2 in which adjustable brackets are provided for mounting the scraper blade, the adjustable brackets being mounted upon the cross beam and having provision for adjustment with respect thereto.

* * * * *

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United States Patent [19]

Makosch

[11] **4,397,237**

[45] **Aug. 9, 1983**

[54] **ROLLER TRAIN STRUCTURE FOR USE WITH PRINTING MACHINE**

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[73] Assignee: **M.A.N.-Roland Druckmaschinen Aktiengesellschaft**, Augsburg, Fed. Rep. of Germany

[21] Appl. No.: **353,608**

[22] Filed: **Mar. 1, 1982**

[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**³ **B41F 31/32**

[52] **U.S. Cl.** **101/352**; 101/247; 118/262

[58] **Field of Search** 101/352, 349, 351, 350, 101/209, 247, 148, 139, 140, 143, 144, 145, 182, 184, 185; 118/262

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Assistant Examiner—Moshe I. Cohen
Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To provide access to an ink application roller (11) located circumferentially about the plate cylinder (1) and behind another ink application roller (10), the inner one (11) of the ink application rollers is secured to an inner support plate (14) which is pivotable together with an outer support plate (13) about a bushing of a bearing (21) retaining a milling roller of the ink train, the outer plate additionally supporting other ink distribution rollers (7, 8) receiving ink from an ink supply roller (3), so that the entire roller train (B) formed by the ink distribution rollers (7, 8) and the inner one (11) of the ink application rollers can be tipped out of engagement position to thereby provide access to those rollers which are located behind the milling roller (9). The system is particularly applicable for a double-parallel ink train arrangement in which the respective ink distribution rollers and application rollers are physically located behind another ink train (A) formed by another roller system (4, 5, 6).

5 Claims, 2 Drawing Figures

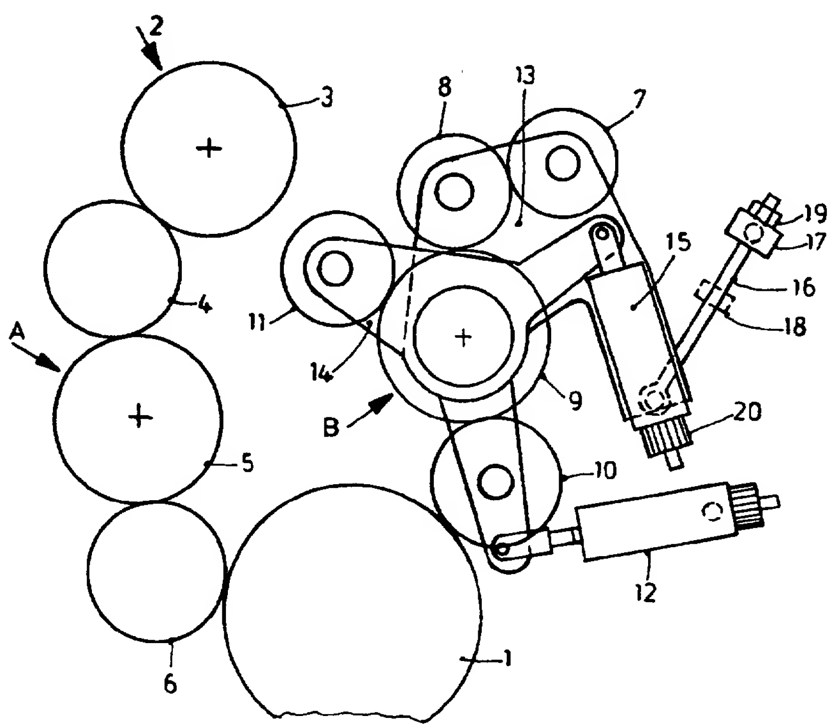

Fig.1

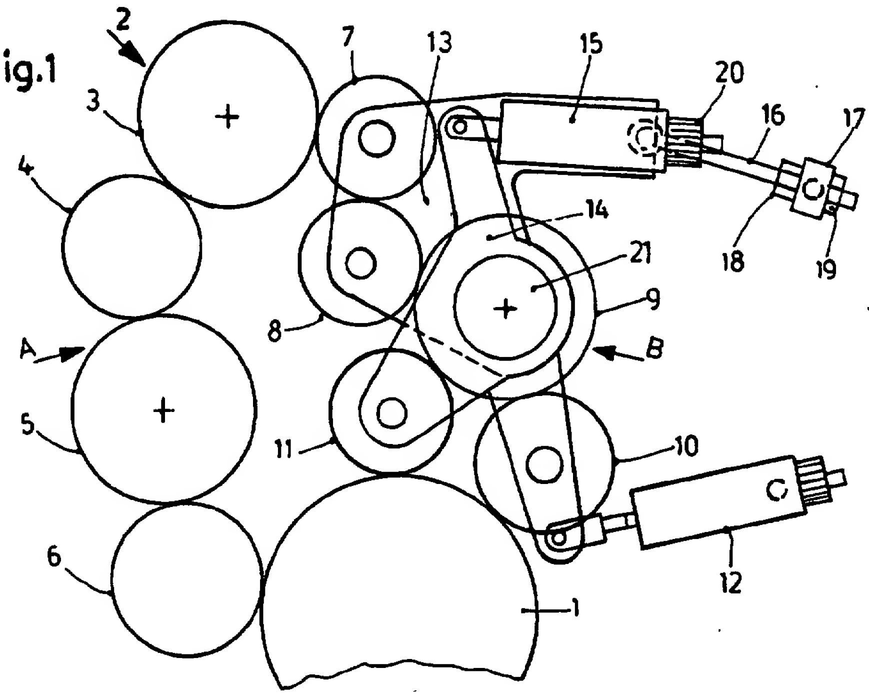
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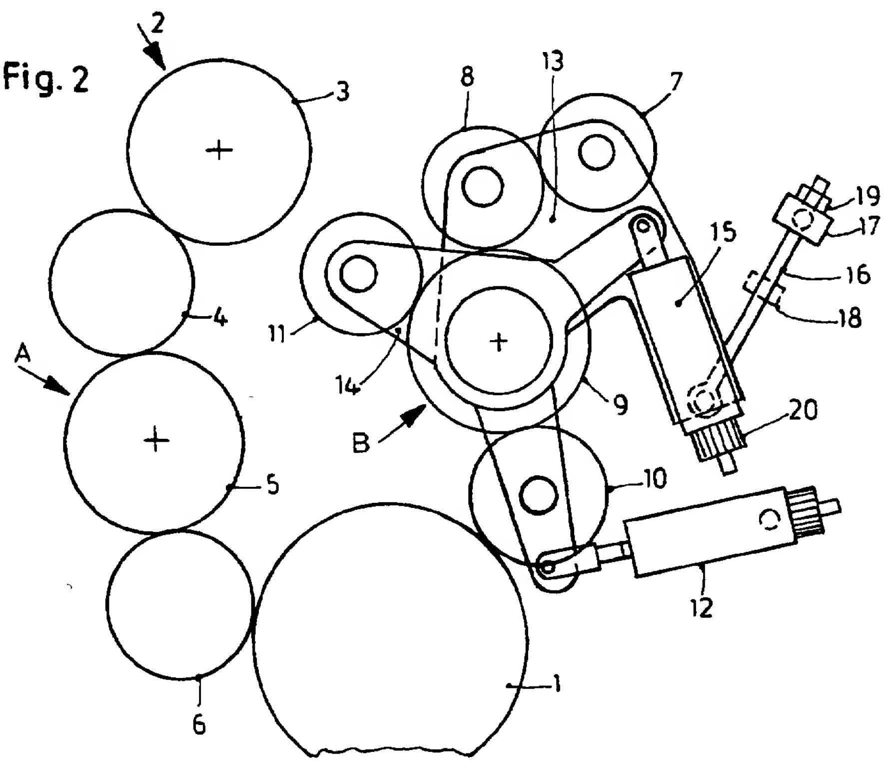
Fig. 2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ROLLER TRAIN STRUCTURE FOR USE WITH PRINTING MACHINE

The present invention relates to a roller train structure which can be applied against a plate cylinder of an offset printing machine or a raised-letter press printing machine, and more particularly to a holder structure suitable for an ink roller train.

BACKGROUND

Roller trains, particularly to distribute ink in the inking system of a printing machine, frequently use a plurality of rollers which are so arranged that some rollers hide other rollers therebeneath, so that access to the inner ones of the rollers is impaired. In some structures, it is desirable to permit movement of rollers towards or away from another engaged roller. British Pat. No. 1,422,421 describes an inking system in which a plate cylinder is inked by a plurality of ink application rollers. The ink application rollers, in turn, receive ink over two roller trains. To permit change-over, or to engage and disengage the inking system, one further roller can be pivoted or tipped about a roller which is journaled in fixed bearings, maintained in a predetermined position in the frame. Such roller trains have disadvantages in that it is difficult to replace certain rollers without disassembling the entire roller train, and particularly without disassembling the rollers which hide the inner ones, or the ones covered thereby. Thus, maintenance and/or exchange of some of the rollers beneath outer ones is difficult, time-consuming, and expensive.

THE INVENTION

It is an object to provide a roller train which permits disassembly or adjustment of any one of the rollers thereof, even though the particular roller may be hidden beneath or behind another one, and without disassembling the outer or covering roller, or roller set or group.

Briefly, a first bearing plate is provided, secured to an outer roller which is maintained in position. The first bearing plate can be pivoted or tilted or rocked about the axis of rotation of this outer roller. At least one roller is retained in the first bearing plate, and in surface engagement with the outermost roller. The bearing plate, further, retains a second bearing plate thereon, which is relatively rotatable with respect to the first one, the second bearing plate supporting at least one inner roller. Positioning control elements are provided secured to the first bearing plate and defining the position of the second bearing plate, and the relative position of the roller or rollers secured thereto. The first bearing plate also has positioning elements associated therewith, permitting rocking or pivoting of the first bearing plate about the axis of rotation of the outermost roller to such an extent that, thereby, the inner rollers which are secured to the second bearing plate become accessible.

The roller train has the advantage that those rollers which, in normal operation, are not readily accessible still can be removed or reached without substantial disassembly time, since it is no longer necessary to disassemble the outer rollers in order to reach, for example, an inner one for replacement because of wear, or for maintenance, or for adjustment. Further, the system is particularly simple to service and to adjust since the inner rollers can be relatively adjusted in their position without requiring disassembly of the outer rollers.

The system can be used in inking systems both for offset as well as for raised-letter presses which have dual or multiple path ink trains. The system further has the advantage that the pivoting arrangement can be easily adjusted by pivoting against a stop so that the positioning of the rollers, after service work, for example on the inner rollers, and after re-positioning, will be retained as controlled, without renewed re-adjustment of the position of outer rollers, which have been tipped or pivoted out of their normal position. Placement of the outer rollers with respect to other rollers or cylinders of the system which have bearings fixed in a frame thus is simple.

DRAWINGS

FIG. 1 is a schematic side view of a portion of the roller train of an inking system, illustrating those parts which are close to the plate cylinder of a rotary offset printing machine, with the rollers in engaged position; and

FIG. 2 illustrates the system of FIG. 1 with the rollers in disengaged or removed position.

The inking system 2 supplies ink to a plate cylinder 1 by applying ink from an ink trough (not shown) and, for example, a ductor roller which supplies the ink necessary for inking of the plate cylinder. Ductor or film-forming or milling rollers may be used in accordance with any known and suitable structure. The ink supply system itself is generally known, and thus not shown in FIGS. 1 and 2. The ink derived from the ink trough is applied to an ink roller 3 and then applied over distribution rollers 4 and 5 to an application roller 6 which provides ink for the plate cylinder 1. This ink train is labeled ink train A. As shown, the ink train is in continuous rolling engagement with the plate cylinder 1.

A parallel ink train B is in rolling contact with the ink roller 3. Ink roller 3 may be a milling roller, and ink is applied to further ink rollers 7 and 8, and from there on a milling roller 9. Two secondary application rollers 10, 11 are in engagement with the milling roller 9 which, together with the application roller 6, provides for uniform inking of the plate cylinder 1.

The secondary ink application roller 11 is positioned inwardly of the rollers 7, 8, 9 and 10, and is therefore hidden behind the rollers. Roller 11 may be termed an inner roller, and access thereto is impeded by the other rollers as well as by the milling roller 9. Thus, the secondary roller 11 cannot be serviced or exchanged or adjusted without removing the outer rollers 8, 9, 10 and, preferably, also roller 7, which together impede access to the roller 11. Roller 10, of course, can readily be exchanged and serviced, and its adjustment position easily controlled by an adjustment element 12, for example a pneumatic or hydraulic cylinder-piston arrangement, which permits engagement and disengagement of the cylinder 10 with the surface of the plate cylinder 1.

In accordance with the invention, the milling roller 9 is secured in bearings 21 in the side walls of the machine (not shown), and thus fixed in position. A first, or outer plate 13 is provided, rotatable or pivotable about the bearing bushings of the milling roller 9. The outer, or first bearing plate 13 is used to receive the bearings of the rollers 7 and 8. Additionally, plate 13 supports a second, or inner bearing plate 14. The second or inner bearing plate 14 is rotatable relative to the outer or first

plate 13 about the axis of rotation of the milling roller 9, for example about the outer bearing bushing thereof.

A similar arrangement, the mirror image of that described, is located at the other axial ends of the rollers. The bearing plate 14, located at the end faces of the milling roller 9 receive the bearings for the secondary ink application roller 11. To properly position the secondary ink application roller 11 in the desired location on the plate cylinder, bearing plate 13 has a positioning element 15 associated therewith, for example a hydraulic or pneumatic piston-cylinder positioning element secured on plate 13, which permits lifting the bearing plate 14 and with it the secondary application roller 11 off the plate cylinder 1 or, alternatively, in engagement therewith; positioned movement of the positioning element 15 coupled to the inner bearing plate 14 is independent of rocking or pivoting movement of the outer bearing plate 13 which carries element 15.

The bearing plate 13 can be pivoted together with the bearing plate 14 by a further positioning element formed by components 16, 17, 18, 19 to pivot the outer bearing plate 13 in clockwise direction about the milling roller 9 so that, in a limiting position, the bearing roller 11, and its adjustment position, is readily accessible—see FIG. 2. This permits, for example, removal of servicing of the roller 11 without the necessity of disassembly of any one of the other rollers of the system.

The locating arrangement for the outer, or first plate 13 includes a guide rod 16 which is pivotably linked to the bearing plate 13 with one end thereof. The other end of the guide rod 16 is threaded and is guided in a rotatable holder 17 which is fixed in position, for example on the frame (not shown) of the machine. Adjustment or positioning nuts 18, 19 are threaded on the guide rod 16 at both sides of the holder 17 so that the position of the guide rod 16 can be predetermined.

Operation: To carry out maintenance work, nut 19 is loosened and, upon rotation of holder 17, the first or outer plate 13, and with it the inner plate 14, is rocked from the position shown in FIG. 1 to the position shown in FIG. 2, where the secondary ink application roller 11 is readily accessible. After carrying out the necessary maintenance work on the secondary ink application roller 11, for example exchange, finishing of the surface thereof, or the like, and while the roller train is in the position of FIG. 2, the position of the adjustment nut 19 is re-established. This insures that the roller 7 will, upon change-over to the position of FIG. 1, have the same distance or engagement pressure with respect to roller 3 which it had prior to pivoting the entire system from the position of FIG. 1 to the position of FIG. 2.

Individual fine adjustment of the ink application roller 11 is carried out by an adjustment button 20, associated with the, preferably pneumatic, lifting or disengagement device 15. As can be seen in FIGS. 1 and 2, the position of the secondary ink application roller 11 with respect to the plate cylinder, once determined by the adjustment knob 20, is not changed when the plates are pivoted about the bearing 21 of the milling roller 9. This substantially simplifies adjustment of the secondary ink application roller 11, and hence results in substantial saving of time. Further, adjustment or maintenance work on the roller 8 of the roller train B is simplified since this roller also becomes freely accessible when the roller train is pivoted or tipped into the position shown in FIG. 2. Roller 8, likewise, can be readily exchanged or its radial position adjusted, as well known, for example by an eccentrically located bearing or the like.

Roller train A has been shown in its simplest standard form; it, of course, can also be constructed similarly to the roller train B, with dual support plates, merely in form of a right-for-left reversed mirror image.

Various changes and modifications may be made within the scope of the inventive concept.

I claim:

1. In combination with a printing machine having a plate cylinder (1),

an ink train system having

an ink distribution roller means (7, 8);

two application rollers (10, 11) positioned in circumferentially offset location about the circumference of the plate cylinder, whereby one roller (11) will be located behind the other roller and thereby form an inner roller (11) of the ink train system;

an ink transfer roller (9) in engagement with both said application rollers (10, 11), and further in engagement with the ink distribution roller means (7, 8);

and bearing means (21) locating the ink transfer roller in a fixed position on a frame of the machine, comprising,

a first outer support plate (13) pivotally mounted to pivot about the axis of rotation of said bearing means (21), said first outer support plate securing thereon the ink distribution roller means (7, 8);

a second, inner support plate (14) pivotally mounted to pivot about the axis of rotation of said bearing means independently of pivoting movement of said outer support plate, said second, inner support plate securing thereon the inner roller (11);

first operating means (16–19) coupled to the first outer support plate (13) to effect and control pivoting movement thereof about the axis of rotation of the transfer roller (9);

and means to render the inner application roller (11) accessible from behind the outer application roller (10) including second operating means (15, 20) coupled to the second, inner support plate (14) and secured to the first outer support plate (13) to control relative positioning of the inner roller (11) with respect to the plate cylinder (1) while permitting rolling movement about the circumference of the transfer roller (9) upon pivoting or tipping the first, outer plate (13) about the axis of rotation of the transfer roller under command of said first operating means.

2. System according to claim 1, wherein said ink train system further includes an ink supply roller (3) and roller elements (4, 5, 6) applying ink from the ink supply roller (3) to the plate cylinder;

and wherein said ink distribution roller means (7, 8) comprises an ink distribution roller (7) in engagement with said distribution roller (3) when said outer plate (13) is pivoted for engagement position of the respective ink distribution roller (7) and said ink supply roller (3) with each other.

3. System according to claim 2 wherein said transfer roller (9) comprises a milling roller.

4. System according to claim 1, wherein said ink train system includes an ink supply roller (3);

and wherein said first operating means comprises adjustable means (17, 18, 19) positioning the ink distribution roller means (7, 8) with respect to said ink supply roller (3) in predetermined location.

5. System according to claim 4, wherein said adjustable means comprises a stop means (18, 19) cooperating with a fixed stop (17) located on the frame of the machine to position the rollers moved upon pivoting movement of the outer plate with respect to the ink supply roller and said plate cylinder in predetermined, adjusted location.

* * * * *

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United States Patent [19]

Simeth

[11] **4,399,767**

[45] **Aug. 23, 1983**

[54] **VARNISHING UNIT IN THE DELIVERY UNIT OF A SHEET-FED ROTARY PRINTING PRESS**

[75] Inventor: **Claus Simeth**, Offenbach am Main, Fed. Rep. of Germany

[73] Assignee: **M.A.N.-Roland Druckmaschinen Aktiengesellschaft**, Fed. Rep. of Germany

[21] Appl. No.: **386,656**

[22] Filed: **Jun. 9, 1982**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 374,150, May 3, 1982, abandoned.

[30] **Foreign Application Priority Data**

May 6, 1981 [DE] Fed. Rep. of Germany 3117855

[51] **Int. Cl.**[3] **B05C 11/00**

[52] **U.S. Cl.** **118/46**; 101/232; 118/236; 118/239; 118/249

[58] **Field of Search** 118/46, 236, 239, 249; 101/232

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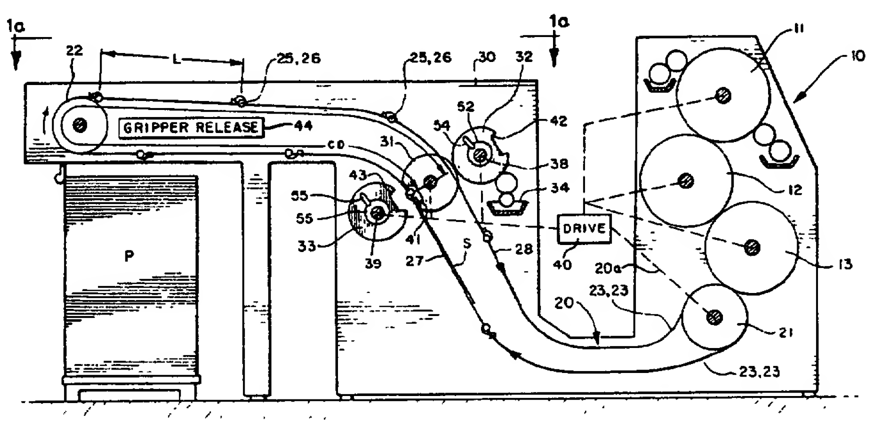
Primary Examiner—Evan K. Lawrence

Attorney, Agent, or Firm—Leydig, Voit, Osann, Mayer & Holt, Ltd.

[57] **ABSTRACT**

An apparatus for varnishing a sheet being fed from a sheet fed printing press into a delivery unit, the sheet being conveyed by an endless loop conveyor made up of a pair of laterally spaced conveyor chains. Cross members extend between the chains at regular intervals carrying grippers for the leading edge of successive sheets. The chains are guided to form a delivery run and a return run spaced apart and generally parallel to one another. An applicator cylinder is journalled between the runs having an axial length which is shorter than the lateral spacing between the chains. A plate cylinder journalled in the frame outside of the return run is in rolling engagement with the applicator cylinder for supplying a varnish film thereto. A backing cylinder journalled in the frame outside of the delivery run is in rolling engagement with the applicator cylinder. The circumference of the cylinders equals the spacing between successive cross members and grippers. The applicator, plate, and backing cylinders have respective longitudinal grooves sufficiently large to provide free passage for the cross members and associated grippers. The cylinders are driven synchronously with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet. The conveyor speed is less than the press speed in a predetermined ratio. The cylinders have a diameter less than the diameter of the cylinders in the associated press unit in the same ratio.

10 Claims, 5 Drawing Figures



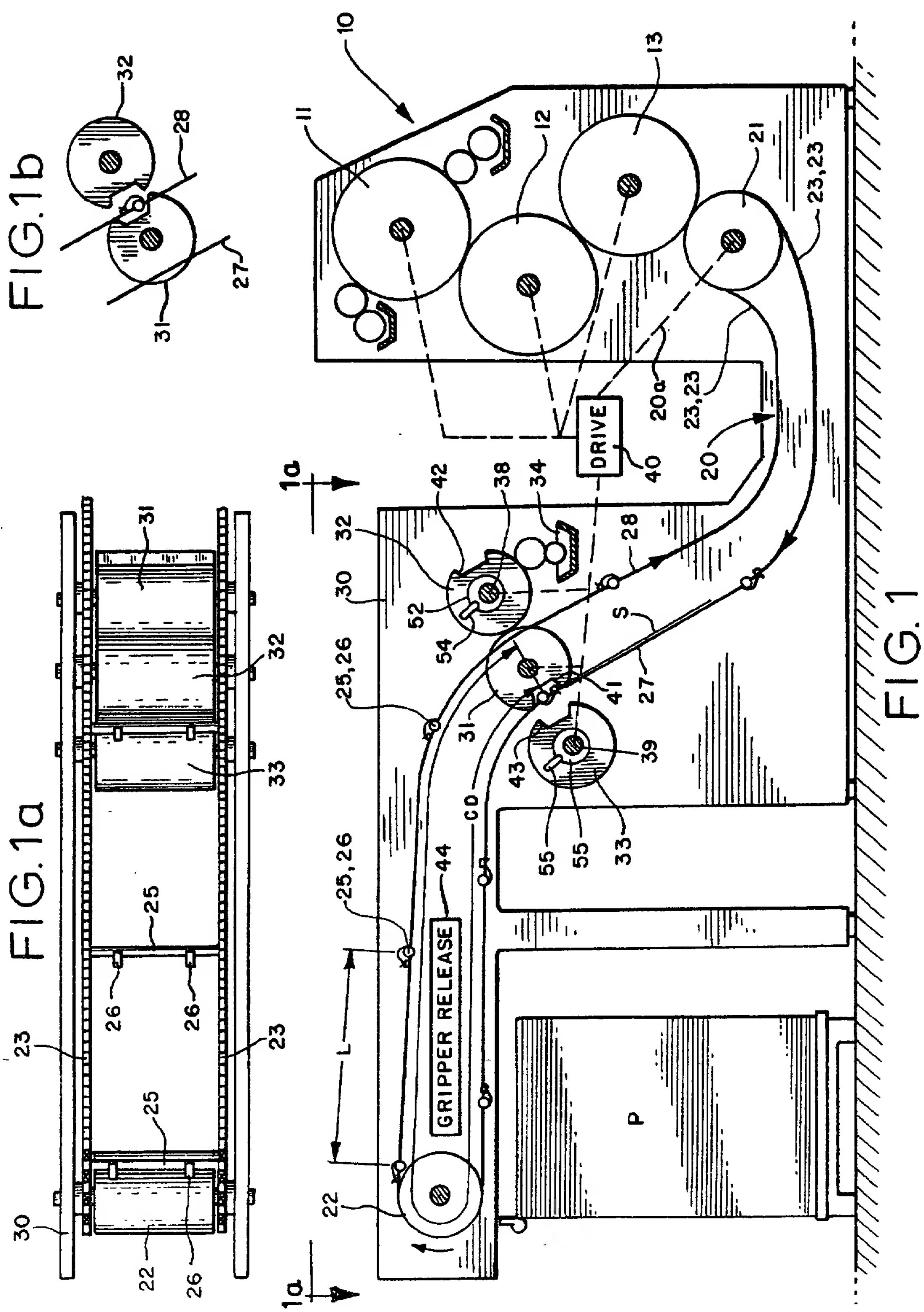


FIG.1b

FIG.1a

FIG.1

FIG. 2

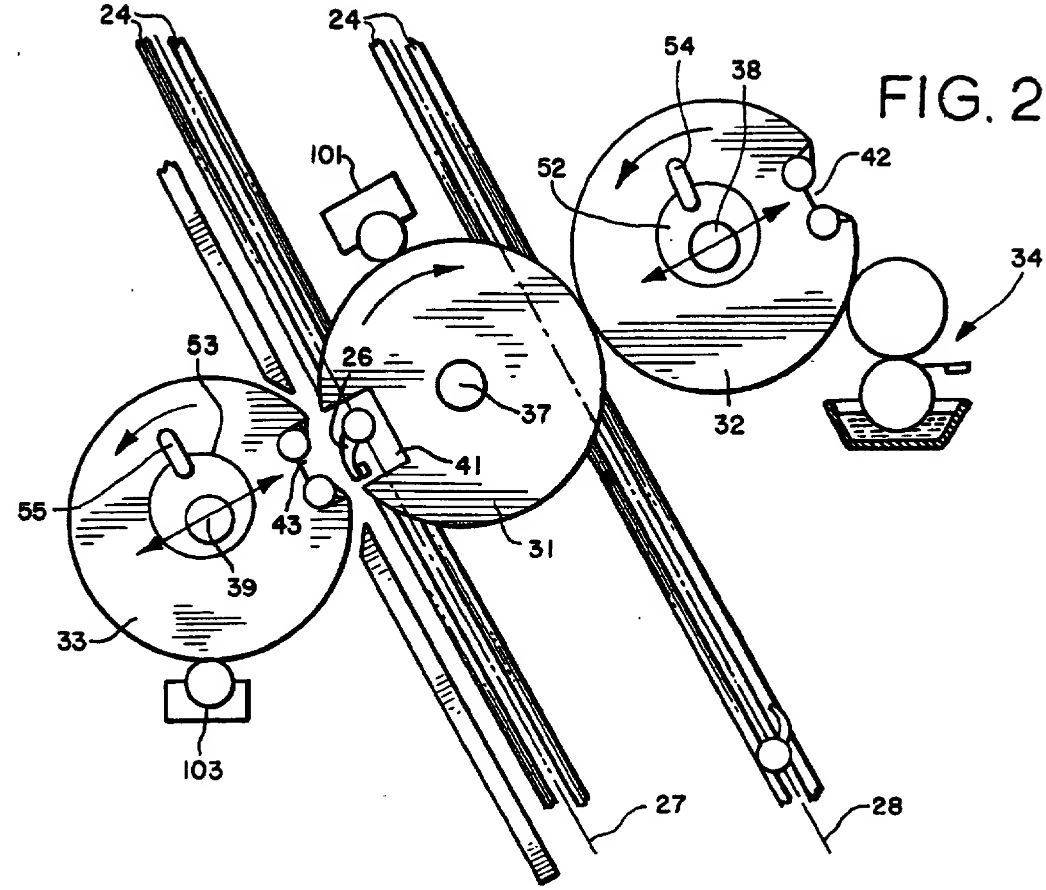

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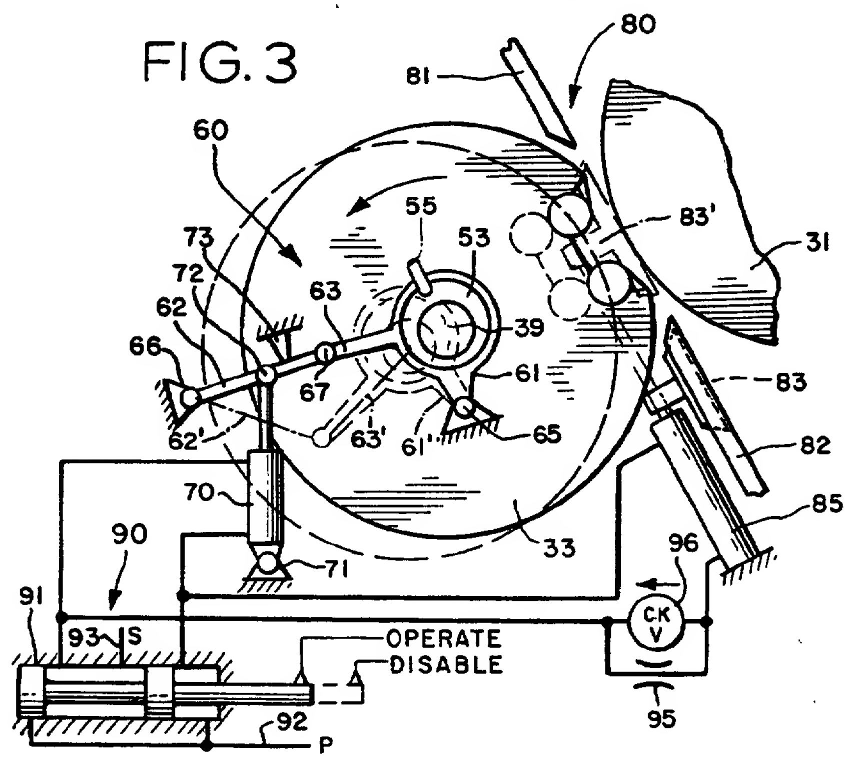
FIG. 3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VARNISHING UNIT IN THE DELIVERY UNIT OF A SHEET-FED ROTARY PRINTING PRESS

This application is a continuation-in-part of application Ser. No. 374,150, filed May 3, 1982, abandoned.

It is known to modify a damping unit in the last printing unit of a printing press to apply varnish to a printed sheet. It is also known to use a separate varnishing unit in the path of the sheets being conveyed from the printing press to the delivery unit.

German Pat. No. 2,020,584 shows application of varnish by the dampening unit of the last printing unit, by a varnishing unit on the last blanket cylinder and by a varnishing unit on a separate sheet guide cylinder. In each case, however, varnishing is at the expense of the last printing unit in the press which must be cut out or modified. An additional printing unit for the application of varnish downstream of the last ink printing unit requires two additional transfer stations, which is quite costly in addition to complicating the construction and maintenance of the machine.

German Pat. No. 2,345,183 describes a varnishing unit which is mounted in the delivery unit instead of in the printing unit. However this requires an additional sheet transfer comprising a transfer and take-off drum with grippers and control means. Again, the machine is quite complicated and costly.

German Pat. No. 1,930,317 teaches the possibility of conveying printed sheets through a number of printing units successively in one gripper operation by means of a transportation system consisting of chains, grippers and guides. However this is a costly system since it acquires large reversing wheels at the ends of the machine to enable the empty run of the transportation system to be returned beneath the printing units.

It is, accordingly, an object of the present invention to provide a simple and readily accessible arrangement for accurate-register varnishing which can be incorporated in the delivery unit of the sheet fed printing press without any appreciable expense in terms of space and material, while the printing units of the machine are not required to be modified or disabled and hence are always available for printing. It is a related object to provide means for achieving accurate-register varnishing which does not require the use of auxiliary transfers by transfer drums of the like and during which the varnishing takes place as a sheet follows a straight line conveyance path.

It is more particularly an object of the invention to provide a varnishing means for use in a delivery which employs a minimum number of parts, which is easily installed and serviced with convenient access, and which is capable of being economically installed in new delivery units or, on a retrofit basis, in units already in the field to provide the advantages of varnishing at lowest possible cost.

It is still another object of the present invention to provide a device of the type described which is highly compact, a device in which both the delivery run and return run of the conveyor have free passage through a groove in the applicator cylinder without necessity for any special synchronizing means, and in which the cylinders are so arranged as to facilitate impression adjustment and throw off.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is an elevational view, somewhat diagrammatic, of a delivery unit for a printing press incorporating provision for varnishing in accordance with the present invention.

FIG. 1*a* is a partial top view of the delivery unit shown in FIG. 1 looking down along the line 1*a*—1*a* therein.

FIG. 1*b* is a fragment showing free passage of cross member and grippers in the return run.

FIG. 2 is an enlarged view of a portion of FIG. 1.

FIG. 3 is a further enlargement showing the provision for throw-off of the backing cylinder and the simultaneous insertion of a sheet guide segment.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIG. 1 of the drawings there is shown, in diagrammatic form, a lithographic printing press unit **10** having the usual plate cylinder **11**, blanket cylinder **12** and impression cylinder **13**. This unit, either acting alone or in tandem with preceding press units, achieves printing on at least one side of the sheet, the sheet being indicated as S. The printing unit **10** discharges into a conveyor **20** having an input drum **21** and output drum **22**. The conveyor is formed of a pair of laterally spaced closed loops of conveyor chain **23** which are trained around sprockets on the drums, the chains being guided between the drums along guide rails **24** (see also FIG. 2). Extending between the loops of chain **23** are cross members **25** which are spaced at equal intervals along the entire length of the chain, the cross members carrying pairs of grippers **26** which grip and transport the leading edges of successive sheets. The conveyor chains are supported to form a relatively straight and parallel delivery run **27** leading from the press unit to the pile P and an idle or return run **28**.

In accordance with the present invention an applicator cylinder is journalled in the frame **30** of the delivery unit between the runs **27**, **28** and having an axial length which is shorter than the lateral spacing between the chains. A plate cylinder journalled in the frame outside of the return run **28** is in rolling engagement with the applicator cylinder. A backing cylinder is journalled in the frame outside of the delivery run **27** for rolling engagement with the applicator cylinder. The circumference of the plate cylinder, applicator cylinder and backing cylinder is the same and equal to the spacing between successive grippers or cross members. At least the applicator cylinder has a longitudinal groove of sufficient size to provide free passage for the cross members and their associated grippers. The cylinders are driven in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinder for application of a film of varnish to the face of the sheet.

Thus, referring to FIGS. 1 and 2, an applicator cylinder **31** is journalled in the frame **30** of the delivery unit between the runs **27**, **28**, the applicator cylinder having an axial length which is shorter than the lateral spacing between the chains (see FIG. 1*a*). For furnishing a film of varnish to the applicator cylinder a plate cylinder **32** is provided, the cylinder being journalled outside of the

return run 28. For applying back up as the sheet is engaged by the applicator cylinder, a backing cylinder 33 is located outside of the delivery run 27.

A varnish fountain 34 acts as a source of varnish for the plate cylinder 32. The plate cylinder 32 carries plates (not shown) which accurately determine the area of the applicator cylinder to which varnish is supplied which, in turn, determines the area over which varnish is applied to the sheet S. The cylinders have respective shafts 37, 38 and 39. As stated, the circumference of each of the cylinders is equal to the spacing L of the successive grippers and cross members. The cylinders and conveyor have a common drive 40.

The conveyor drive connection 20a which drives the conveyor 20 is such that the speed of the conveyor is less than press speed in a predetermined ratio. The applicator cylinder 31, plate cylinder 32 and backing cylinder 33 have a diameter and surface speed which is less than the diameter and surface speed of the cylinders in the associated press unit 10 in the same ratio.

In carrying out the invention the applicator cylinder 31 is provided with a groove 41 large enough to provide free passage for the cross members 25 and the grippers 26 thereon in the delivery run 27. The plate cylinder 32 and backing cylinder 33 have mating grooves 42, 43 respectively which are preferably of similar span.

In operation, with the cylinders 31-33 driven in synchronism with the conveyor chains, the cross members and grippers pass freely between the cylinders 31, 33 and a sheet S, passing on the grippers is engaged between the applicator and backing cylinders for application of a film of varnish to the face of the sheet. When the sheet leaves the cylinders 31, 33 it passes to a position above the delivery pile P where the grippers are released by an automatic gripper release mechanism 44 so that the sheet is deposited on the pile. The grippers thus return empty over the upper, or return run 28 of the conveyor.

In accordance with one of the aspects of the invention in its preferred embodiment, the spacing between the delivery run 27 and the return run 28 is less than the diameter of the applicator cylinder 31 so that the applicator cylinder is more or less symmetrically overlapped by each of the runs. The length of the conveyor delivery and return loop defined by the applicator cylinder, and indicated at CD in FIG. 1, is preferably equal to $NL+L/2$ where N is a low integer and L is the gripper-to-gripper spacing so that the cross members and grippers passing in the return run are freely and idly accommodated in the groove 41 of the applicator cylinder and in the mating groove 42 of the plate cylinder which rotate in synchronism with one another. This condition of idle accommodation is shown in FIG. 1b. In short, the successive cross members and grippers are accommodated in the groove 41 of the applicator cylinder 31 in both the delivery and return directions resulting in a high degree of compactness of the assembly. The fact that the three cylinders 31, 32 and 33 are of a diameter less than the diameter of the cylinders in the regular printing press unit 10 similarly contributes to compactness.

For the purpose of adjusting the plate cylinder 32 back and forth with respect to the applicator cylinder 31, an eccentric sleeve 52 is provided. Moreover, for adjusting the backing cylinder in a direction toward and away from the applicator cylinder, a similar eccentric sleeve 53 is provided. Such sleeves, having operating handles 54, 55 respectively, are duplicated at the opposite ends of the cylinders. Slight rocking movement of the sleeve 52 increases, or decreases, the impression of the plate cylinder with respect to the applicator cylinder, while rocking the eccentric sleeve 53 of the backing cylinder, on the other hand, provides independent control of the impression between the backing and applicator cylinders.

In accordance with one of the detailed aspects of the present invention the backing cylinder 33 is mounted upon a swingable throw-off linkage for swinging between a working position in which the backing cylinder is in engagement with the applicator cylinder and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder. The linkage in the present instance, generally indicated by the numeral 60 (FIG. 3), includes a first arm 61 which mounts the shaft 39 of the cylinder, a second or actuating arm 62, and an intermediate link 63. The arms 61, 62 are pivoted to the frame of the machine at pivots 65, 66 respectively, while the arm 62 is connected to the link 63 by a pivot 67.

For the purpose of swinging the actuator arm 62 from its retracted position to the illustrated working position, a pneumatic or hydraulic actuator 70 is used pivoted to the frame at 71 and pinned, at 72, to the central portion of the arm 62. A limit stop, or reference stop, 73 defines the limit of movement of the arm 62 slightly beyond dead center and hence the degree of extension of the actuator.

When the actuator 70 is in its expanded state, the eccentric sleeve 52 is in working position but subject to rocking movement for control of impression as discussed above. When the actuator 70 is, on the other hand, contracted, the arm 62 is drawn away from the stop 73 and the elements comprising the linkage 60 retreat to the retracted positions 61', 62' and 63' shown by the dotted lines in FIG. 3. Using the geometry shown, the backing cylinder will be withdrawn from the applicator cylinder by an amount which substantially exceeds 20 millimeters.

As a further feature of the invention the throw-off mechanism includes a sheet guide segment with means for interposing the segment between the backing cylinder and the applicator cylinder as the backing cylinder is retracted, so that the sheet is not pressed into engagement with the applicator cylinder and does not receive any varnish. Thus, referring again to FIG. 3, the sheet guide 80 normally consists of two spaced sections 81, 82 having a gap between them enabling the backing and applicator cylinders 31, 33 to engage one another In carrying out the invention a bridging segment 83 is provided mounted on the plunger of an auxiliary actuator 85 so that the segment 83 normally occupies its retracted position but, upon extension of the actuator 85, occupies its bridging position 83' shown by the dotted outline.

The movements of the actuators 70, 85 may be coordinated by connecting them in a hydraulic circuit generally indicated at 90 having a spool valve 91 connected to a source of pressurized fluid 92 and to a sump 93. In the condition of the mechanism illustrated in FIG. 3 the actuator 70 is pressurized for extension and the actuator 85 is pressurized for retraction, which is the operating condition. When it is desired to retract the blanket cylinder, the spool in the valve 91 is shifted into the dotted "disable" position in which the actuator 70 is pressurized for retraction and the actuator 85 is pressurized for extension. When it is desired to retract the backing

cylinder, the spool in the valve **91** is shifted into the dotted "disable" position in which the actuator **70** is pressurized for retraction and the actuator **85** is pressurized for extension. A restriction **95** in the line leading the actuator **85** ensures a time delay in the extension of the guide segment to permit time for the backing cylinder to get out of the way. The restriction **95** is, however, bypassed by a check valve **96** to ensure rapid retraction of the guide segment when the backing cylinder is moving back into its operating position.

The thickness of the film of the varnish applied by the applicator cylinder to the sheet is dependent, in part, upon the surface of the applicator cylinder. A minimum of varnish is applied when the surface of the applicator cylinder is smoothly polished. A maximum is applied when the applicator cylinder has a matt or "screened" surface. In accordance with one of the aspects of the present invention the applicator cylinder has means for alternatively mounting thereon replaceable surface elements of conforming cylindrical shape having (a) a smooth polished surface and (b) a matte surface, respectively. In the simplest aspect of the invention the wrap-around elements may be in the form of a thin metal sheet (not shown) of the wrap-around type, with the ends of the sheet being held by any convenient flexible plate lockup of conventional design (also not shown).

To facilitate clean up, separate washing units **101**, **103** may be mounted for bringing into engagement with the surfaces of the applicator cylinder **31** and a backing cylinder **33**, respectively, it being understood that such washing units are per se well known in the art. In practice the backing cylinder **33** is covered with a resilient blanket which may be substituted by a blanket having a different degree of stiffness, as desired. The term "guide rails" as used herein referes to any means which may be used to guide the conveyor chains along predetermined delivery and return runs.

It will be apparent that the objects of the invention have been amply fulfilled. The varnishing cylinders in the delivery accomplish accurate-register varnishing cheaply, conveniently and compactly saving the expense of a separate varnishing unit. When varnish is not required it is a simple matter to throw the control valve **91** into its "disable" position, protection being automatically provided for the passing sheet.

I claim:

1. An apparatus for varnishing a sheet being fed from a sheet-fed printing press unit into a delivery unit comprising, in combination, a frame, guide rails in the frame, a pair of conveyor chains laterally spaced from one another on the guide rails to form an endless loop conveyor extending from the press unit to a delivery pile, the chains having cross members at regular intervals, grippers at the cross members for gripping the leading edge of a sheet, the guide rails being arranged to form a delivery run and return run spaced apart and generally parallel to one another, an applicator cylinder journalled in the frame in a position in which it is overlapped by each of the runs but having an axial length which is shorter than the lateral spacing between the chains, means supported on the frame outside of the return run and in rolling engagement with the applicator cylinder for supplying a film of varnish thereto, a backing cylinder journalled in the frame outside of the delivery run and in rolling engagement with the applicator cylinder, the circumference of the cylinders being equal to the spacing between the successive cross members and grippers, the applicator cylinder having a longitudinal groove sufficiently large to provide free passage for the cross members and associated grippers in both the delivery run and the return run, means for driving the cylinders in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet.

2. An apparatus for varnishing a sheet being fed from a sheet-fed printing press unit into a delivery unit comprising, in combination, a frame, guide rails in the frame, a pair of conveyor chains laterally spaced from one another on the guide rails to form an endless loop conveyor extending from the press unit to a delivery pile, the chains having cross members at regular intervals, grippers at the cross members for gripping the leading edge of a sheet, the guide rails being arranged to form a delivery run and return run spaced apart and generally parallel to one another, an applicator cylinder journalled in the frame between the runs having an axial length which is shorter than the lateral spacing between the chains, means supported on the frame outside of the return run and in rolling engagement with the applicator cylinder for supplying a film of varnish thereto, a backing cylinder journalled in the frame outside of the delivery run and in rolling engagement with the applicator cylinder, the circumference of the cylinders being equal to the spacing between the successive cross members and grippers, the applicator and backing cylinders having respective longitudinal grooves sufficiently large to provide free passage for the cross members and associated grippers, means for driving the cylinders in synchronism with the conveyor chains so that a sheet passing on the grippers is engaged between the applicator and backing cylinders for application of varnish to the sheet.

3. The combination as claimed in claim 1 or in claim 2 in which the speed of the conveyor is less than press speed in a predetermined ratio, the cylinders being of the same diameter and surface speed, which diameter and surface speed is less than the diameter and surface speed of the cylinders in the associated press unit in the same ratio.

4. The combination as claimed in claim 1 or in claim 2, the spacing between the delivery run and the return run being somewhat less than the diameter of the applicator cylinder so that the applicator cylinder is symmetrically overlapped by each of the runs, the length of the conveyor delivery and return loop defined by the applicator cylinder being equal to $NL+L/2$ where N is a low integer and L is the gripper-to-gripper spacing so that cross members and grippers passing in the return run are idly accommodated in the groove of the applicator cylinder.

5. The combination as claimed in claim 1 or in claim 2 in which the means for supplying a film of varnish includes a plate cylinder.

6. The combination as claimed in claim 1 or in claim 2 in which the backing cylinder is mounted upon a swingable throw-off linkage including a toggle for swinging between a working position in which the backing cylinder is in engagement with the applicator cylinder with the toggle on center and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder.

7. The combination as claimed in claim 1 or in claim 2 in which the backing cylinder is mounted upon a swingable throw-off linkage including a toggle for swinging between a working position in which the

backing cylinder is in engagement with the applicator cylinder with the toggle on center and a retracted position in which the backing cylinder is spaced at least 20 millimeters away from the applicator cylinder and in which the throw-off mechanism includes a sheet guide segment with means for interposing the segment between the backing cylinder and the applicator cylinder as the backing cylinder is retracted so that the sheet is held safely away from the applicator cylinder free of transfer of any varnish therefrom.

8. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has a smooth polished surface.

9. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has a matte surface.

10. The combination as claimed in claim 1 or claim 2 in which the applicator cylinder has means for alternatively mounting thereon replaceable surface elements of conforming cylindrical shape having (a) a smooth polished surface and (b) a matte surface, respectively.

* * * * *

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United States Patent [19]

Fischer

[11] **4,421,027**

[45] **Dec. 20, 1983**

[54] **MULTIPLE PRINTING MODE PRINTING MACHINE SYSTEM**

[75] Inventor: **Hermann Fischer**, Augsburg, Fed. Rep. of Germany

[73] Assignee: **M.A.N.-Roland Druckmaschinen Aktiengesellschaft**, Offenbach am Main, Fed. Rep. of Germany

[21] Appl. No.: **360,068**

[22] Filed: **Mar. 22, 1982**

[30] **Foreign Application Priority Data**

Apr. 25, 1981 [DE] Fed. Rep. of Germany 3116505

[51] **Int. Cl.**[3] **B41F 11/00**; B41F 5/24; B41F 7/36; B41L 25/14

[52] **U.S. Cl.** **101/142**; 101/148; 101/177; 101/179; 101/216; 101/352; 101/DIG. 28

[58] **Field of Search** .... 101/DIG. 28, 42 S, 148, 101/147, 349–352, 136, 137, 141, 142, 177, 179, 180, 216, 217, 218, 220

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Primary Examiner—Edgar S. Burr
Assistant Examiner—David A. Wiecking
Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To permit, selectively, lithographic printing, flexo printing, or direct lithographic printing on a printing machine with the same direction of rotation of the respective cylinders, a liquid application system (**11**) including a liquid application roller (**15**) is selectively positionable for engagement either with a plate cylinder (**4, 5**) of a lithographic system, the rubber blanket cylinder (**2, 3**) for direct lithographic printing, the plate cylinder then acting as a form ink transfer cylinder which is being continuously inked; or for engagement with the blanket cylinder, with a flexo printing plate applied to the blanket cylinder, and the plate cylinder being placed out of engagement with the blanket cylinder, the damping liquid for lithographic printing being replaced by flexo-printing ink, and the position (FIG. 3) being as close to the printing or impression line as possible, and between the zone of operation of the plate cylinder (4) and the printing cylinder (2) to prevent drying of the quick-drying flexo-printing ink.

8 Claims, 5 Drawing Figures

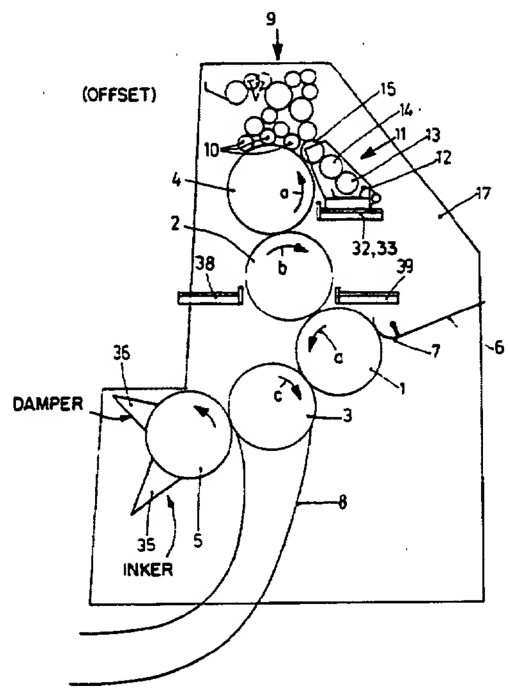
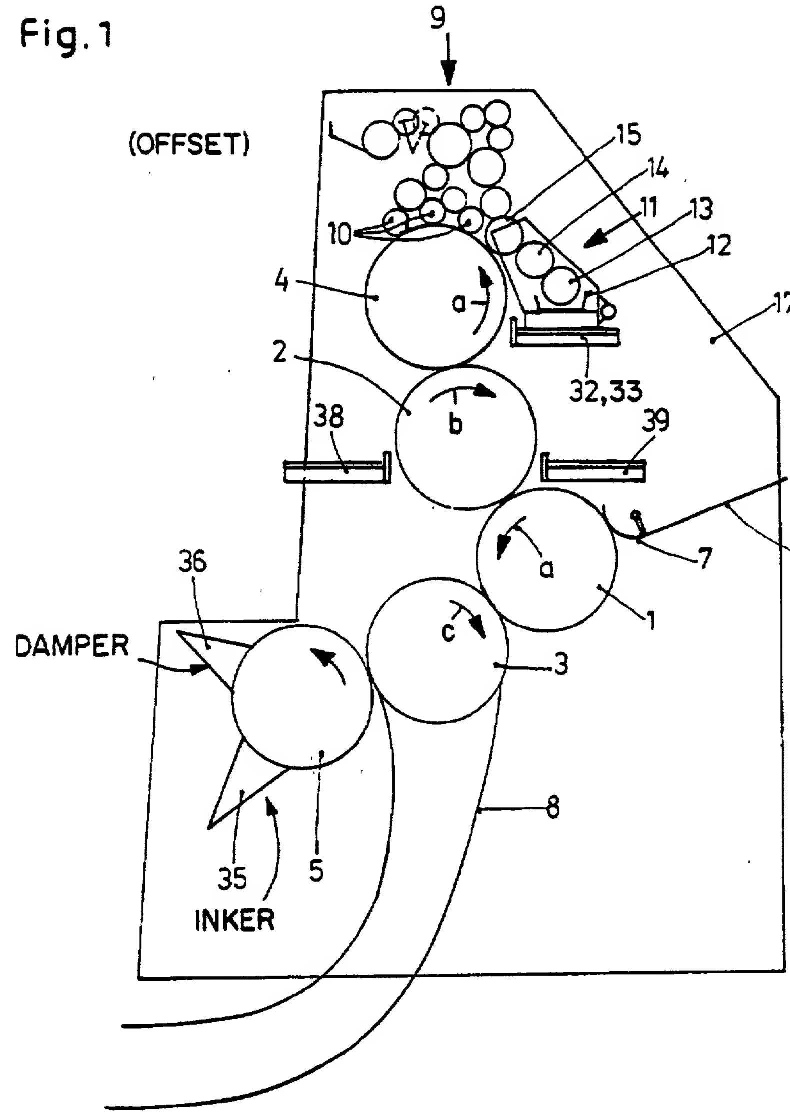


Fig. 1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(OFFSET)
15
14
11
13
12
10
4
a
17
2
32,33
b
38
39
a
6
7
36
1
DAMPER
c
3
8
35
5
INKER

Fig.2

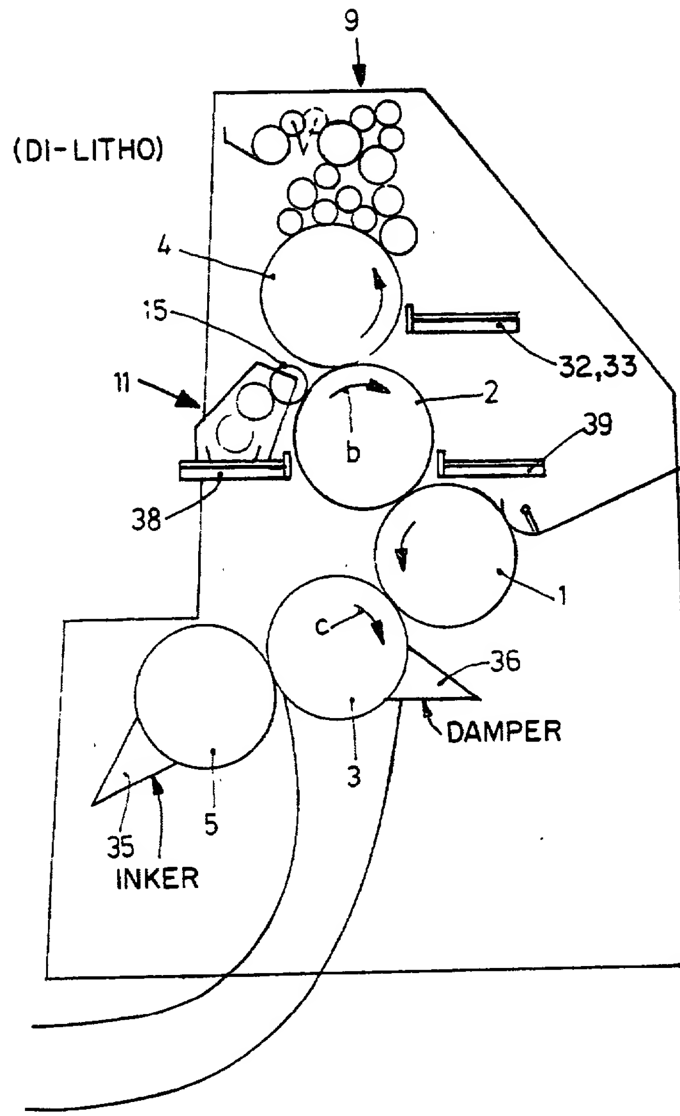
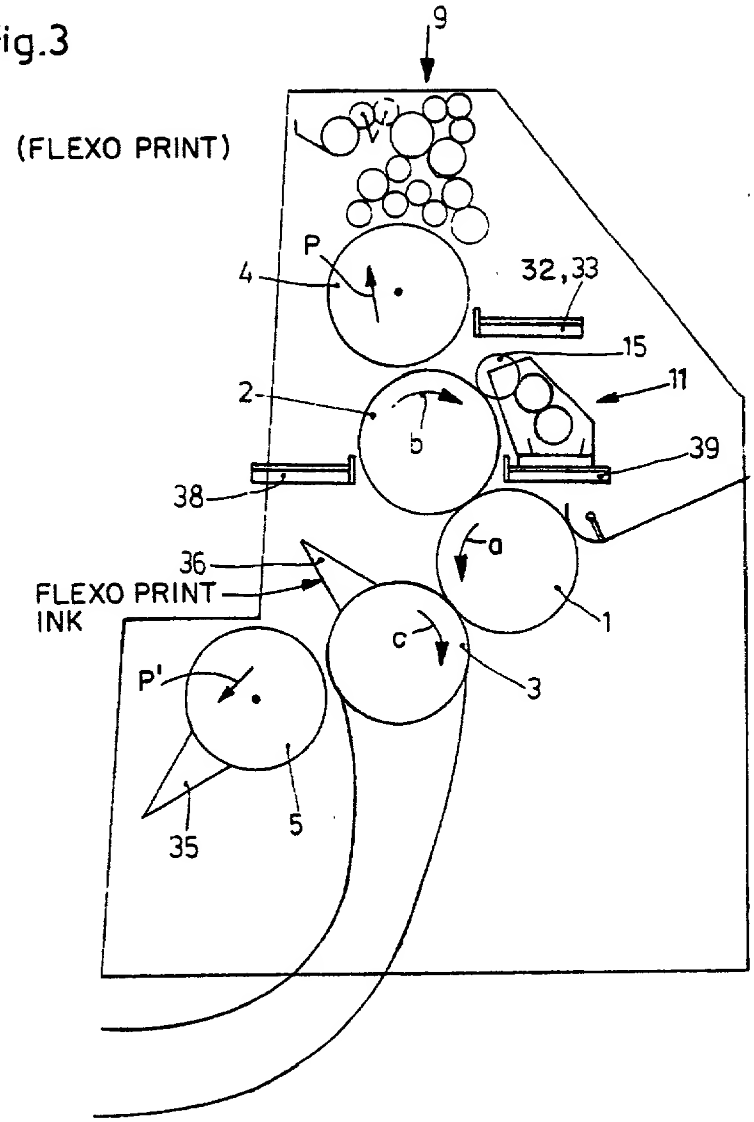


Fig.3



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(FLEXO PRINT)
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FLEXO PRINT INK
1
c
3
P'
5
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Fig. 4

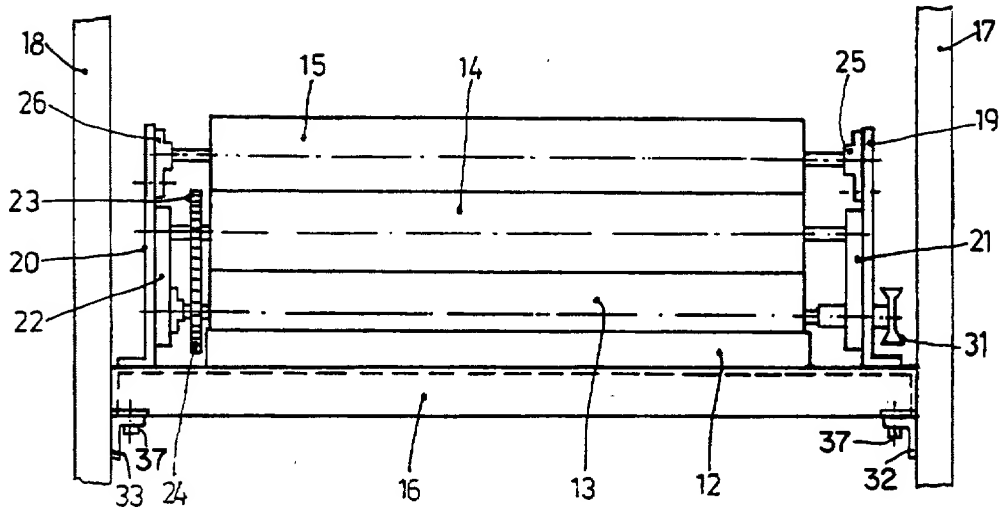
18
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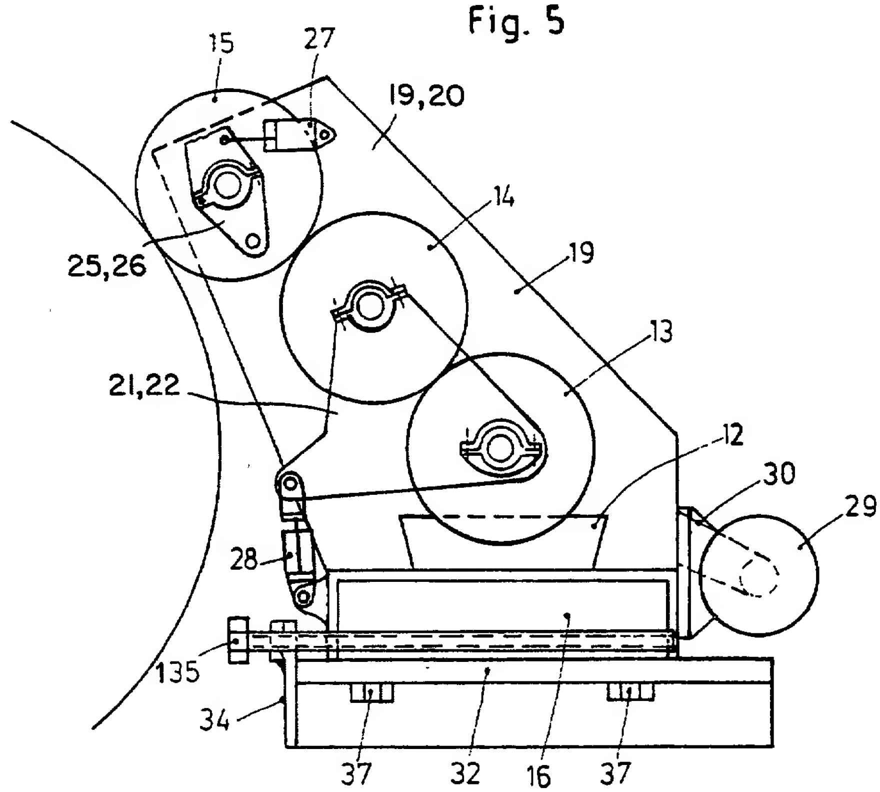
Fig. 5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MULTIPLE PRINTING MODE PRINTING MACHINE SYSTEM

Reference to related application, assigned to the assignee of the present invention, the disclosure of which is hereby incorporated by reference: U.S. application Ser. No. 360,065, filed Mar. 22, 1982 by the inventor hereof, now U.S. Pat. No. 4,397,235, issued Aug. 9, 1983.

The present invention relates to a rotary printing machine system having at least one printing system retaining, within side walls thereof, a plate cylinder and a blanket cylinder, as well as an inker and a damper, and in which the damper can be selectively positioned to permit selectively different printing modes of operation.

BACKGROUND

A machine of a type to which the present invention relates is described in German Published Patent Application No. DE-AS 1 611 239. This machine can operate both in raised letters, or offset printing mode. The cylinders of the printing machine can operate in either direction, so that the paper path on which printing is to be effected can be suitably selected. The paper path is passed through the printing system which includes two plate cylinders and two blanket cylinders. In offset printing, the plate on the plate cylinder continuously has damping liquid applied thereto prior to inking thereof. For damping, a slinger-type damping system is provided, selectively positionable between two positions on the plate cylinger. When raised letter printing is to be effected, the slinger damping system is removed.

THE INVENTION

It is an object to expand the printing mode capability of a machine of the basic type as described to additionally permit operation of the machine utilizing flexo printing, that is, to permit, in dependence on printing job requirements, offset printing, direct lithographic printing or flexo printing.

Briefly, the damping system includes a trough in which a pickup roller dips, supplying liquid to a transfer roller for subsequent supply of liquid to an application roller. The damping system, selectively, can be placed in various working positions, for example by cooperating with the plate cylinder of an offset printing plate, with a blanket cylinder of a direct lithographic printing plate, or, in a third position with a flexo printing plate placed on the rubber cylinder, in which the plate cylinder then is disengaged from contact with the blanket cylinder, the trough of the damping system then being filled with flexo printing ink rather than with offset damping liquid, such as water.

The system has the advantage that the direction of movement of the respective cylinders need not be changed, that is, remains the same regardless of the type of printing mode which is selected. Thus, the invention is applicable to various types of machines, including those which are most simply constructed and can operate only in one direction of rotation. The invention is applicable both to sheet-fed printing machines as well as to paper web-fed machines, without structurally interfering with the basic arrangement of the machine.

DRAWINGS

FIG. 1 is a schematic side view of a printing machine, arranged for standard offset printing;

FIG. 2 is a side view of the machine of FIG. 1, set up for direct lithography (DiLitho) printing;

FIG. 3 is a side view of the machine of FIG. 1 set up for flexo printing;

FIG. 4 is a fragmentary end view, partly cut away, of the damping system of the machine; and

FIG. 5 is a schematic side view of the damping system of FIG. 4 shown to an enlarged scale.

The machine illustrated is capable of printing with two colors in offset mode. A make-ready table (FIG. 1) 6, having grippers 7, supplies a sheet of paper to the impression cylinder 1. One color of printed information is supplied from rubber blanket cylinder 2 and plate cylinder 4. The other color is supplied by a printing system including the rubber blanket cylinder 3 and plate cylinder 5. The sheet is transported out of the printing station by a transport chain system 8, formed with grippers (not shown). The respective grippers on the impression cylinder 1 likewise have been omitted for clarity of the drawings and may be in accordance with any standard construction.

An inker, generally shown at 9, and having a plurality of ink application rollers 10, is located in surface contact with the plate cylinder 4. It may be of any standard and suitable construction. Further, a damper 11 is provided which has a trough 12 of damping liquid in which a ductor roller 13 dips. The ductor roller 13 is in surface contact with a transfer roller 14. Transfer roller 14 may be axially oscillating. A liquid application roller 15 receives liquid from the roller 14 and applies it to the plate cylinder 4 in advance of ink applied by the application rollers 10.

The damper 11 is shown in greater detail in FIGS. 4 and 5. to which reference will be made: a carrier 16 is provided extending from one side wall 17 of the printing machine over to the side wall 18 (FIG. 4). Two plates 19, 20 are secured to the carrier 16. Plates 19, 20 extend parallel to the side wall 17,18. The plates 19, 20 retain two rocking links 21, 22, pivotable or swingable about the axis of rotation of the liquid pickup roller 13. The liquid pickup roller 13 and the transfer roller 14 are journalled between the links 21, 22 and are connected by gears 23, 24. Two further pivot links 25, 26 are located on the plates 19, 20, retaining the liquid application roller 15. The respective links are located in controlled position by hydraulic positioning elements 27, 28, for example cylinder-piston arrangements. By suitable application of hydraulic liquid, the application roller 15 and the transfer roller 14 can be placed, respectively, in quiescent or working position.

The support carrier 16 further supports an electric motor 29 which is connected by a belt drive 30 with a sheave 31, driving the pickup roller 13.

The carrier or support 16, and hence the damper 11, is secured in place at the inner surfaces of the side walls 17, 18 by being supported on support rails 32, 33 attached to the side walls, for example by welding. The ends of the support rails 32, 33 each are formed with a flange 34 through which an engagement bolt 135 is threaded in order to determine the correct position of the carrier 16 and with it the damper 11 with respect to the remaining cylinders and rollers of the printing machine. When properly positioned, the carrier 16 is secured in place on the machine by bolts 37, engaging through elongated holes or slots formed in the rails 32, 33.

A similar system is provided for the plate cylinder 5. The damper 36 and the inker 35 thereof are shown only

schematically, since it may be identical to the arrangement of the damper 11 and the inker 9, or the mirror image thereof.

Operation, Offset Printing with Reference to FIG. 1: The damper 11 is secured on the carrier rails 32, 33. The damping liquid application roller is engaged on plate cylinder 4. Additionally, it may be in contact with one of the rollers of the inker 9 (see FIG. 1). Similarly, the inker 35 and the damper 36 are in engagement with the plate cylinder 5.

Upon starting of the machine, plate cylinders 4, 5 first have damping liquid applied thereto and thereafter they are inked. The printing information is transferred to the blanket cylinders 2, 3. Upon rotation in the direction of the arrow a of the impression cylinder, the sheet supplied by the grippers 7 from the make-ready table 6 is first printed by a first color ink by blanket cylinder 2 and, upon subsequent transfer of the sheet to the impression or printing line between impression cylinder 1 and blanket cylinder 3, printing with a second color ink is effected.

DiLitho Mode, FIG. 2: The damper 11 is removed from the rail 32. In accordance with a feature of the invention, a further set of rails 38 is located on the side walls 17, 18 of the machine to receive the damper 11 as a unit. The damper 11, thus, is applied to the second set of rails 38 (FIG. 2). In this mode of operation, the liquid application roller 15 is in engagement with the rubber blanket cylinder 2.

In similar manner, the damper 36 is applied to the blanket cylinder 3. The plate cylinders 4, 5 are coated with a continuous film of ink and thus provide, in effect, a continuous inking surface and form part of the inking system. For example, a rubber blanket may be applied to the plate cylinder. The blanket cylinders 2, 3 have a direct lithographic printing plate secured thereto.

The set of rails 38 is so arranged that the application roller 15 of the damper 11 contacts the circumference of the blanket cylinder 2 between the printing or impression line thereof, with respect to the impression cylinder 1, and the contact line of the plate cylinder 4, looked at in the direction of the arrow b. Similarly, the damper 36, again looked at in the direction of the arrow c, is positioned between the impression line between the blanket cylinder 3 and the impression cylinder 1 and the contact line between the blanket cylinder 3 and the plate cylinder 5. Consequently, in operation, the DiLitho plate on the blanket cylinder 2 is first wetted by the damper and thereafter inked by the plate cylinder 4. Similarly, the DiLitho plate on the blanket cylinder 3 is first wetted and then inked. Thereafter, printing is effected between the blanket cylinder 2 and the impression cylinder 1 in one color ink, and between the blanket cylinder 3 and the impression cylinder 1 with another color, for example.

Flexo Printing with Reference to FIG. 3: In accordance with a feature of the invention, a third set of rails 39 is secured to the side walls of the machine 17, 18. The third set of rails is used to locate the damper 11 when flexo printing is desired. The liquid application roller 15 is engaged with the blanket cylinder 2. Similarly, the damper 36 is engaged with the blanket cylinder 3. Contrary to the position for DiLitho printing, however, the application roller 15 is so positioned that it is as close as possible to the printing or impression line with the impression cylinder 1. The plate cylinders 4, 5 are removed from contact with the blanket cylinders 2, 3, for example by rocking the centers of rotation of the respective shafts by a link, an eccenter, or the like as schematically shown by arrows P, P'.

The blanket cylinders 2, 3 each have a flexo printing plate secured thereto. The damping liquid is removed from the trough 12 of the damping system and flexo printing ink is placed therein. The set of rails 39 is so arranged that the application roller 15 of the system 11 contacts the circumference of the blanket cylinder 2, looked at in the direction of rotation of arrow b, between the zone close to the plate cylinder 4 and the impression line of the printing cylinder 1.

The arrangement of the damping, or liquid application system 11, as described, permits application of flexo printing ink shortly before the flexo printing plate on the plate cylinder 2 reaches the impression line with the impression cylinder 1, so that drying of the rapidly drying flexo ink on the plate of the blanket cylinder 2 is prevented.

Similarly, the liquid application system 36 with respect to the lower printing system is repositioned as shown in FIG. 3, so that the blanket cylinder 3, which will have a flexo printing plate applied thereto, will have flexo printing ink applied thereon shortly before reaching the impression line with the impression cylinder 1. Printing is effected in two-color prime printing.

Various changes and modifications may be made, and the modes of printing operation can be selected as desired; for example, different modes of printing can be used for different colors being applied. For example, a blanket cylinder 3 may have a DiLitho plate applied thereto, and the blanket cylinder 2 a flexo printing plate, each one of the respective cylinders 2, 3 being operated in accordance with the appropriate printing mode.

It is obvious that the system, as described, can also be used with a three-cylinder printing system which, for example, only includes the impression cylinder 1, a blanket cylinder 2, and a plate cylinder 4. Further, of course, it is also possible to apply the invention to a four-cylinder printing system in which the two blanket cylinders 2, 3 are in engagement with each other which apply, respectively, prime and verso printing at the same time.

The type of substrate on which printing is to be effected can be as selected, and the machine is equally applicable for sheet printing or for continuous web printing.

Various changes and modifications may be made within the scope of the inventive concept.

I claim:

1. Multiple printing mode rotary printing machine system for selectively printing in
   (a) offset printing mode;
   (b) direct lithographic printing mode;
   (c) flexographic printing mode, having two side walls (17, 18);
   a blanket cylinder (2, 3) located between the side walls;
   cylinder means (1) for forming a printing or impression cylinder and defining, with the blanket cylinder,
   a printing line;
   a plate cylinder (4, 5) located and retained between the side walls adjacent the blanket cylinder (2, 3), said plate cylinder being movable into and out of engagement with the adjacent blanket cylinder;
   an inker (9) selectively engageable with the plate cylinder;
   and a liquid application system (11)

wherein, in accordance with the invention,

the liquid application system (11) is a film system having a liquid trough (12), a pickup roller (13) at least in part located in the trough, a liquid transfer roller (14), and a liquid application roller (15);

and first, second and third individual positioning and support means (32, 33; 38; 39) are provided, located on said side walls for selectively positioning and supporting said liquid application system in accordance with a selected mode of printing of the machine, comprising

(a) for offset printing: the first support means (32, 33) being located for, and supporting the liquid application system adjacent to and in liquid transfer contact with said plate cylinder (4, 5) in advance—with respect to the direction of rotation (a) of the plate cylinder—of the inker (9);

and wherein the liquid in the liquid trough comprises damping liquid;

(b) for direct lithographic printing: the second support means (38) being located for and supporting said liquid application system adjacent to and in liquid transfer contact with said blanket cylinder (2, 3) in advance—with respect to the direction of rotation (b) of the blanket cylinder—of said plate cylinder (4, 5);

wherein the liquid in the liquid trough comprises damping liquid; and

wherein said plate cylinder supplies ink to the blanket cylinder from the inker;

(c) for flexo printing: the third support means (39), being located for and supporting said liquid application system adjacent to and in liquid transfer contact with said blanket cylinder (2, 3) in advance—with respect to the direction of rotation (b) of the blanket cylinder—of the printing line and in the zone adjacent the blanket cylinder between the plate cylinder and said printing line;

wherein the liquid in the liquid trough (12) comprises flexo printing ink; and

wherein said plate cylinder is out of contact with the blanket cylinder, the blanket cylinder carries a flexo printing plate.

2. Printing machine system according to claim 1, wherein said first, second and third positioning means comprise rails (32, 33; 38, 39) for selective placement of the liquid application system (11) thereon.

3. Printing machine system according to claim 1, further comprising a carrier structure (16) supporting the liquid application system as a unit;

and an individual drive motor (29) secured to the carrier structure.

4. Printing machine system according to claim 3, where the first, second and third support means (32, 33; 38, 39) comprise rails

and said support structure (16) is secured to said rails.

5. Printing machine system according to claim 3, wherein two plate elements (19, 20) are secured to said support structure (16), extending parallel to the side walls (17, 18) when the liquid application system is located on any one of said positioning and support means;

and wherein the rollers (13, 14, 15) are secured to said parallel plates (19, 20).

6. Printing machine system according to claim 4, further including holding and clamping means (37) for securely attaching and clamping the support structure (16) to the respective rails.

7. Printing machine system according to claim 2, further including position adjustment means (35) secured to said rails for providing an adjustable abutment for the liquid application system (11) on the rails to permit adjustable reproducible positioning of the liquid application system on the rails and for liquid transfer contact of the respective cylinder with the liquid application roller (15) of the liquid application system upon selective placement of the system on any one of said positioning support means.

8. Printing machine system according to claim 4, further including position adjustment means (35) secured to said rails for providing an adjustable abutment for the liquid application system (11) on the rails to permit adjustable reproducible positioning of the liquid application system on the rails and for liquid transfer contact of the respective cylinder with the liquid application roller (15) of the liquid application system upon selective placement of the system on any one of said positioning support means.

* * * * *

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United States Patent [19]

Fischer

[11] **4,423,677**

[45] **Jan. 3, 1984**

[54] **ROTARY SHEET OFFSET PRINTING MACHINE**

[75] Inventor: **Hermann Fischer**, Augsburg, Fed. Rep. of Germany

[73] Assignee: **M.A.N.-ROLAND Druckmaschinen Aktiengesellschaft**, Offenbach am Main, Fed. Rep. of Germany

[21] Appl. No.: **353,230**

[22] Filed: **Mar. 1, 1982**

[30] **Foreign Application Priority Data**

Mar. 7, 1981 [DE] Fed. Rep. of Germany 3108808

[51] **Int. Cl.³** **B41F 13/24**

[52] **U.S. Cl.** **101/232**; 101/184

[58] **Field of Search** 101/232, 247, 182–185, 101/174–175

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Primary Examiner—E. H. Eickholt

Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To permit double inking of the blanket cylinder (6, 7; 44, 45) of an offset printing machine, in which all the cylinders are the same, and further to permit retrofitting of an existing printing machine, a control unit (C) is connected to the blanket cylinders which are located in movable bearings to engage or disengage the blanket cylinders, in intermittent movement, from a cooperating impression cylinder (8, 9; 46) when a sheet supply apparatus (3, 41) is commanded to feed a sheet only for every other revolution of the printing system, thereby permitting double inking of the blanket cylinder and preventing contact of the inked blanket cylinder with the impression cylinder when no sheet is being fed thereto.

6 Claims, 4 Drawing Figures

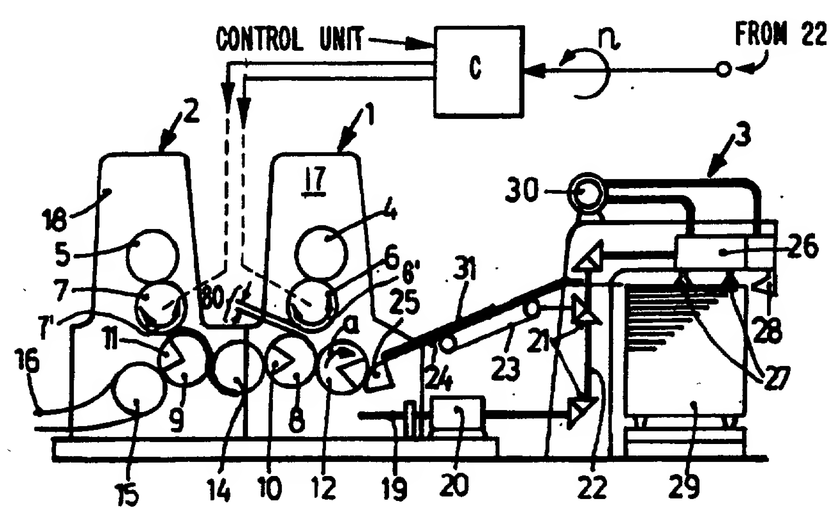


Fig.1

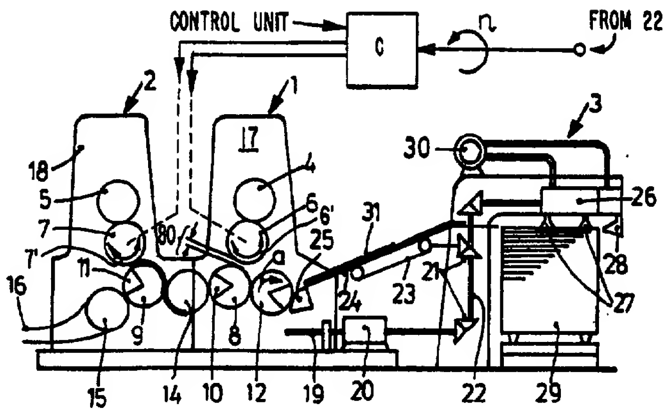


Fig.2

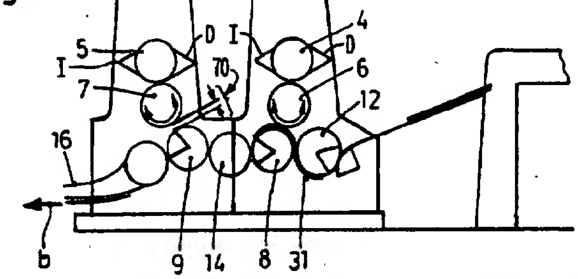


Fig. 3

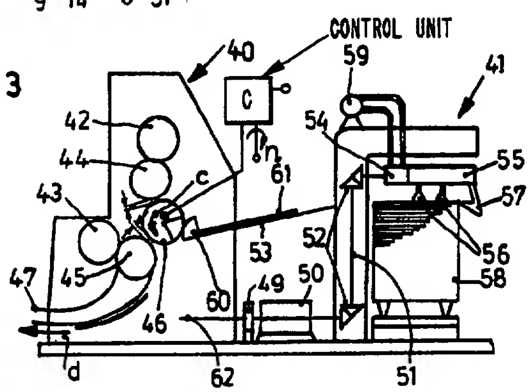
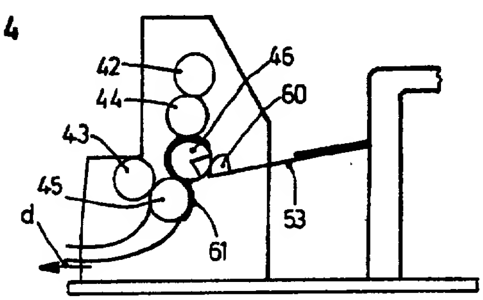


Fig.4



ROTARY SHEET OFFSET PRINTING MACHINE

Cross reference to related applications, assigned to the assignee of this application, the disclosure of which is hereby incorporated by reference:

U.S. Ser. No. 353,229, filed Mar. 1, 1982 now as U.S. Pat. No. 4,409,894 Oct. 18, 1983, FISCHER (claiming priority Fed. Rep. Germany No. P 31 08 806.6); U.S. Ser. No. 353,235, filed Mar. 1, 1982 now U.S. Pat. No. 4,414,896 Nov. 15, 1983, FISCHER (claiming priority Fed. Rep. Germany No. P 31 08 807.4);

The present invention relates to offset printing machines and more particularly to a sheet-fed rotary offset printing machine having a sheet supply apparatus, and which is so arranged that the operating conditions of the machine can be readily matched and headed background. A rotary offset printing machine of the type to which the present invention relates has a plate cylinder and at least one rubber or blanket cylinder, continuously in contact with the plate cylinder and further an impression or printing cylinder; all the cylinders have the same diameter. A printing machine of this type is described, for example, in Walenski, "Einführung in den Offsetdruck", pp. 113, 114 and 137 ("Introduction to Offset Printing"). The blanket cylinder is inked once and provides for printing once for each revolution. Many printing jobs can be carried out by a machine of this type, and satisfactory reproduction of printed subject matter is entirely possible. In some instances, however, inking the rubber cylinder once for each impression is not enough; this may occur when the requirements for printed quality are particularly high and if highly viscous ink is used or the printed substrate, typically paper, has an uneven surface.

It has been proposed, see the aforementioned book, page 113, to utilize a blanket cylinder with an impression cylinder of twice the size and which carries a sheet only about half its circumference, the other half of the circumference being set back with respect to the first half. Thus, for each revolution of the printing cylinder, two revolutions of the associated blanket cylinder will result, causing the blanket cylinder to be inked twice. Based on the construction of the machine, however, double inking will necessarily result at all times, even if the particular printing job would not require double inking as such.

THE INVENTION

It is an object to provide a printing machine in which change-over of single, or double inking of the blanket cylinder can be readily accomplished without changing the size or arrangement of the cylinders of the machine, so that, double or sing inking can be controlled as required. For one mode of operation, double inking can be effected. For normal or ordinary operation, the machine can likewise operate with only a single inking step for each passage of a sheet therethrough.

Briefly, the plate cylinder, the blanket cylinder and the printing or impression cylinder all have the same diameter. The machine is associated with a sheet supply apparatus which can be operated in two speed ranges so that, depending on its adjustment, the cylinders will receive a sheet for each revolution or only for every other revolution; if only half the number of sheets, per unit time, are commanded, that is, for every other revolution, the rubber cylinder and the printing cylinder are separated from each other in such a manner that after a

sheet has passed between the blanket cylinder and the associated printed cylinder a subsequent free running or free wheeling revolution or cycle is controlled during which the rubber blanket cylinder and the printing or impression cylinder are separated from each other, to permit inking of the blanket cylinder without an impression being printed, or transferred to a sheet of paper.

DRAWINGS

FIG. 1 is a schematic side view of the printing machine arranged to carry out the different printing operations in accordance with the present invention;

FIG. 2 is a fragmentary view of FIG. 1 in a different operating phase thereof;

FIG. 3 is a second embodiment of a printing machine; and

FIG. 4 is a schematic side view of the machine of FIG. 3 in a different operating phase than that of FIG. 3.

Embodiment of FIGS. 1 and 2: A two color sheet offset rotary printing machine in serial construction is illustrated. The machine has two printing stations 1, 2 and a common sheet supply apparatus 3. Each one of the printing stations 1, 2 has a plate cylinder 4, 5, a rubber blanket cylinder 6, 7, and a printing or impression cylinder 8, 9. Inkers I and dampers D associated with the plate cylinders and rubber cylinders 6, 7 are shown only schematically in FIG. 2; they have been omitted from the other Figures of the drawings for clarity. They can be of any suitable and well known construction. The printing cylinders 8, 9 have grooves 10, 11 which retain sheet grippers, not shown in detail and which may be of any well known suitable construction. A sheet supply drum 12, which is also formed with grippers is provided. The printing station 2 includes sprocket wheels 15 which retain a chain conveyor 16 having suitable grippers to transport the printed sheets to a sheet delivery station, not shown and of any suitable and well known construction.

In accordance with the invention, each one of the blanket cylinders 6, 7 is so journaled at the side walls 17, 18 of the printing stations 1, 2 that it can be selectively moved in a curve about the plate cylinders 4, 5 respectively, to assume the positions shown in FIGS. 1 and 2, respectively. Contact with the associated plate cylinders 4, 5 is continuously maintained. Movement of the blanket cylinder 6, 7 in this manner can be readily obtained by journaling the blanket cylinders in bearings which are retained in eccenters positioned in the respective sidewall 17, 18 of the printing stations. Movement of the blanket cylinders, by rotating the eccenters, can be obtained, for example, by hydraulic cylinder-piston arrangements or similar apparatus. The hydraulic positioning piston, or similar apparatus, is operated in timed sequence by an electrical or mechanical control unit C to thereby control the positioning of the respective blanket cylinder 6, 7. A suitable control unit may, for example, be a timer element providing electrical control pulses to open, or close an electrically controlled valve to admit pressurized hydraulic fluid to a hydraulic positioning piston or to drain hydraulic fluid therefrom; a suitable mechanical control unit may be a pushrod operated by a cam. Positioning devices of this type are known, and were used in the past to control introduction of the first sheet from a stack into the printing machine and subsequently thereto to engage the blanket cylinder with the printing cylinder independent of the feeds to the respective printing line. The present inven-

tion, thus, can use this portion of the existing equipment, modified merely to be able to carry out the additional function required thereof in accordance with the present invention, which will be described in detail below.

The sheet supply apparatus 3 is driven from a main driveshaft 19 of the machine over a two-stage change gear box 20 and a drive train having bevel wheel gearing therein to provide the right-angle drive, as schematically shown at 21. The drive train 22 is coupled to conveyor belt 23 which supplies sheets over a make-ready table 24 to a gripper pickup 25. The drive train 22 further is connected to transmit rotary power to a sheet lifting or pickup device 26 which has longitudinally movable suction cups or suction grippers 27 and separating jet nozzles 28, to pick up the uppermost sheet from a stack of sheets 29 and supply that uppermost sheet to the make-ready table 24. The sheet pickup device 26 not only includes mechanical means to move the suction cups 27 but, additionally, control means which supply the suction grippers 27 with vacuum for suction and the nozzle 28 with compressed air for separation of sheets. Compressed air and suction, that is, the pneumatic system is supplied from a pump 30. The gear box 20 has a selectable transmission ratio of 1:1 and 2:1.

Operation, with reference to FIGS. 1 and 2:

The printing machine is illustrated for operation for double inking of the blanket cylinder 6, 7. FIG. 1 illustrates the machine at the instant of time in which the gripper pickup apparatus 25 picks up a sheet 31. The blanket cylinder 6 is spaced from the associated printing or impression cylinder, as schematically indicated by the spacing lines 18 A sheet has just entered the printing station 2, and is being printed-on by being passed between the blanket cylinder 7 and the printing or impression cylinder 9, which are in engagement with each other.

Upon rotation of the printing machine from the position shown in FIG. 1, in the direction of the arrow a as shown on the sheet supply drum 12, the gripper pickup 25 will after short movement of the sheet 31 forwardly, transfer the sheet to the gripper of the printing cylinder 8. Upon further rotation of the printing cylinder 8 so that the groove 10 (FIG. 1) thereof will reach a tangential position with respect to the blanket cylinder 6, the blanket cylinder 6 is engaged with the printing cylinder 8, so that the sheet 31 will receive the first impression thereon. After rotation of the cylinder 6 for one revolution, starting from the position shown in FIG. 1, that is, by 360°, the various cylinders will have the position shown in FIG. 2. Upon further rotation of the cylinders, the sheet 31 is transferred to the transport drum 14 which supplies the sheet thereafter to the impression cylinder 9. As soon as the trailing end of the sheet 31 has left the niche between the cylinder 6 and 8, blanket cylinder 6 is disengaged from the impression cylinder 8 in order to prevent smearing or soiling of the surface of the impression cylinder 8 during the subsequent idle or free wheeling phase of the blanket cylinder 6. The blanket cylinder 6, however, remains in continuous contact with the plate cylinder 4 so that, during this idle or free wheeling phase, it can receive an inked impression from the plate cylinder 4.

As soon as the leading edge of the sheet 31 has reached the gap between the cylinders 7 and 9, blanket cylinder 7 is engaged with the impression cylinder 9. Subsequently, and during the passage of the sheet between cylinders 7 and 9, the sheet is printed with the second color. When the leading edge of the sheet 31 reaches chain 16, the grippers thereof receive the sheet and carry the sheet off in the direction of the arrow b to a sheet delivery station (not shown). As soon as the trailing end of the sheet 31 has left the impression line between the cylinders 7 and 9, the blanket cylinder 7 is disengaged from the impression cylinder 9, retaining, however, contact with the plate cylinder 5. During the subsequent free wheeling or idling phase of the blanket cylinder 7, which extends for a full revolution thereof, the blanket cylinder receives an additional inking with the second color. The lifted-off condition of the blanket cylinder 7 is shown schematically by the gap 17 in FIG. 2.

Multiple color printing with double-inking results in the decrease in the number of sheets imprinted on per unit time. The number of sheets, which is half with respect to a single-inking printing is obtained by changing the gearing in gear box 20 to a transmission of 2:1 so that, with respect to the revolutions of the cylinders in the printing machine, only half the number of sheets are supplied by the gripper pickup 25 to the machine system, in comparison to the number of sheets for single-inking operation.

Operation of the machine to carry out ordinary, single-sided two-color printing without double inking is known, so that a description thereof is not necessary.

Embodiment of FIGS. 3 and 4:

A sheet offset rotary printing machine having a double printing station 40 and a printing supply device 41 is so constructed that two plate cylinders 42, 43 are in continuous rotary engagement with two blanket cylinders 44, 45, cooperating with a common impression cylinder 46. The blanket cylinders 44, 45 can be moved in position with respect to the impression cylinder 46, by eccentrically located bearings or by pivoting levers. The engagement with the associated plate cylinders 42, 43 is maintained. The two ends of the blanket cylinder 45 have a sprocket wheel attached thereto - not shown in detail, which guides a sheet removal chain 46, supplied with grippers to pick up sheets and transport them to the removal station. The inking systems and damping systems associated with the plate cylinders have not been shown and may be of any suitable construction.

A main drive shaft 62 receives driving power over a belt drive 49 from a motor 50. The main drive shaft 62 is connected to a drive train 51 having bevel gears 52 thereon. The drive train 51, similar to the drive train shown in FIG. 1, has branch gearing arrangements which are used to drive transport belts or conveyors of a make-ready table 53 and additionally are connected to a control unit 54 and a sheet lifting apparatus 55 having suction grippers 56 and compressed air nozzles 57. The sheet lifting or separating device 55 operates the suction grippers 56 such that they pick up the uppermost sheet of a stack of sheets 58 and supply that sheet to the make-ready table 53. Suction and compressed air lines extend from the control unit 54 to a pump 59. The control unit 54 controls supply of suction air as well as of compressed air to the suction grippers 56 and to the nozzle 57, respectively, in such a manner that, upon setting of the printing machine to single inking, the suction grippers are connected upon each movement to the suction source, in order to supply a sheet from the stack 58 to the make-ready table 53.

If double-inking is desired, the control unit 54 so controls suction air and compressed separating air that pneumatic suction and blowing air is supplied only upon each second movement of the lifting device 55. Simi-

larly, the compressed air nozzle 57 receives compressed air, in clocked sequence, only when the grippers or suction cups 56 are connected to the source of vacuum. Thus, and with reference to machine operating speed, only half the number of sheets is removed from the stack and supplied to the machine than the number which, at the same operating speed of the machine, is supplied to the make-ready table 53 when normal, single-inking is required or commanded. Pickup grippers 60 transfer the sheet from the make-ready table 53 to the printing cylinder 46.

Operation: Starting from the position of the elements shown in FIG. 3, the printing cylinder 46 is moved in the direction of the arrow c. After a short movement, a sheet 61 is supplied by the pickup 60 thereto and transported to the printing line between the blanket cylinder 44 and the printing cylinder 46. The blanket cylinder 44 is engaged with the printing cylinder 46 just before the leading edge of the sheet 61 reaches the printing or contact line. Printing is effected between the cylinders 44 and 46 with the first color.

As the leading edge of the sheet 61 approaches the blanket cylinder 45, blanket cylinder 45 is engaged with the printing cylinder 46. Immediately thereafter, the grippers of the chain 47 grip the sheet which thereby is transferred from the grippers of the printing cylinder 46. During the following phase of sheet movement between the printing cylinder 46 and the blanket cylinder 45, printing is effected by a second color. When the trailing end of the sheet 61 leaves the printing or impression line between cylinders 44 and 46, the blanket cylinder 44 is returned in the position shown in FIG. 3. The blanket cylinder 44 remains in contact with the plate cylinder 42 and thus is inked thereby. Similarly, as soon as the trailing end of the sheet 61 leaves the printing line between the blanket cylinder 45 and the impression cylinder 46, the blanket cylinder 45 is disengaged from the printing cylinder 46 but remains in contact with the plate cylinder 43 so that the blanket cylinder, during the sequence idling revolution, or idling phase, will receive an additional coating of ink. The gaps between the blanket cylinders 44, 45 and the impression cylinder 46 are, respectively, illustrated by the dimension line between the respective cylinders in FIG. 3, unnumbered, however, for clarity of presentation.

Various changes and modifications may be made, and features in connection with one of the embodiments may be used with the other, within the scope of the inventive concept. Thus, a control unit similar to control unit C (FIG. 1) can be used in the embodiment of FIGS. 3 and 4 to effect respective engagement and disengagement of the blanket cylinder 44, 45 with the impression cylinder 46, coupled and synchronized with operation of the pneumatic control unit 54, and hence also synchronized with the rotation of the respective cylinders. Rotary information is entered in the control unit C (FIG. 1) as schematically indicated by the arrow n derived, for example, from a mechanical connection with the drive train 22.

I claim:

1. Rotary sheet offset printing machine having

a sheet supply apparatus (3, 41);

at least one plate cylinder (4, 5; 42, 43);

at least one rubber blanket cylinder (6, 7; 44, 45) associated with the at least one plate cylinder and, during printing, positioned for continuous contact therewith;

means (I) for supplying ink to the at least one plate cylinder;

and a printing, or impression cylinder (8, 9; 46),

said at least one blanket cylinder and said impression cylinder being relatively shiftable with respect to each other for selective printing engagement or for surface separation, respectively;

wherein, in accordance with the invention,

all said cylinders have the same diameter;

said sheet supply apparatus (3, 41) has two different sheet supply rate settings to supply, for one predetermined cylinder speed, in a first supply setting, a predetermined number of sheets per unit time and, for said same predetermined cylinder speed, in a second supply setting, half the number of predetermined sheets per unit time;

and control means (C) are provided, connected to and controlling the relative position of the at least one blanket cylinder (6, 7; 44, 45) and the printing, or impression cylinder (8, 9; 46) such that

(a) when said sheet supply apparatus is in the second supply setting, the blanket and impression cylinders are moved to a separated position during a first revolution of the cylinders to provide for inking of the blanket cylinder, and the blanket cylinder and the impression cylinder are moved to engaged position during a second or subsequent revolution, to permit double inking of the blanket cylinder from the plate cylinder without transfer of printing information from the blanket cylinder after the first inking, and printing on a sheet during said subsequent revolution,

and

(b) when said sheet supply apparatus is in said first supply setting, the blanket and impression cylinders are in continuous printing engagement to provide for single inking of the blanket cylinder and sheet feed at said predetermined number per unit time.

2. Printing machine according to claim 1, wherein said control means (C) moves the blanket cylinder (6, 7; 44, 45) away from the impression cylinder in movement about the circumference of the associated plate cylinder (4, 5; 42, 43).

3. Printing machine according to claim 1, including a main drive shaft (19) connected to drive the sheet supply apparatus (3);

and a two-step gear change box (20) included in the drive shaft having two transmission ratios of 1:1 and 2:1, respectively.

4. Printing machine according to claim 1, wherein said sheet supply apparatus (41) comprises means for lifting and pickup of a sheet including pneumatic means (55) to lift sheets (61) from a stack (58) of sheets;

and the control means controls the pneumatic device for pneumatic suction application, and hence lifting of the sheet, selectively, for each pickup or lifting movement of said sheet supply apparatus or, selectively, for every other sheet pickup or lifting movement thereof.

5. Printing machine according to claim 4, wherein said control means includes a pneumatic control apparatus.

6. Printing machine according to claim 1, wherein a main drive shaft (19, 62) is provided, coupled to a drive train (21, 52) connected to said sheet supply apparatus and to said printing cylinders;

and wherein said control means (C) operates in synchronism with rotation of said drive train.

* * * * *

36

United States Patent [19]

Abendroth et al.

[11] **4,446,814**

[45] **May 8, 1984**

[54] **DEVICE FOR APPLYING A FLUID, IN PARTICULAR LACQUERS ON PRINTED SHEETS OR CONTINUOUS WEBS**

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[73] Assignee: **M.A.N. - Roland**, Fed. Rep. of Germany

[21] Appl. No.: **347,144**

[22] Filed: **Feb. 9, 1982**

[30] **Foreign Application Priority Data**

Feb. 12, 1981 [DE] Fed. Rep. of Germany 3105020

[51] Int. Cl.³ **B05C 1/00**

[52] U.S. Cl. **118/694**; 118/46; 118/262

[58] **Field of Search** 118/694, 259, 665, 262, 118/46, 210; 101/363

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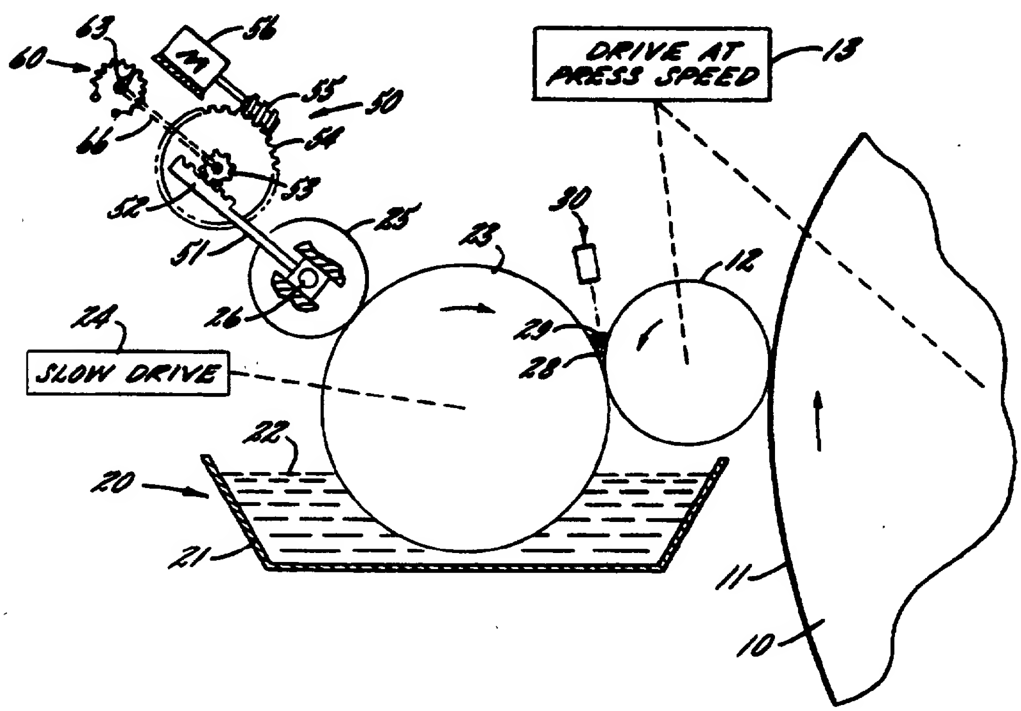
Primary Examiner—John P. McIntosh
Attorney, Agent, or Firm—Leydig, Voit, Osann, Mayer & Holt, Ltd.

[57] **ABSTRACT**

A device for application of lacquer or the like to a sheet in a printing press. The lacquer is applied by an applicator cylinder having an associated applicator roller. Lacquer is fed from a fountain having a fountain roller which is slowly driven, the lacquer being transferred from the fountain roller to the applicator roller either directly or through intermediate rollers to form a nip in which the lacquer tends to build up. The amount of lacquer transferred by the fountain roller per unit time is determined by a metering roller which engages the fountain roller. A sensing device located at the nip senses the level of lacquer buildup and produces an output signal upon departure of the building from an optimum level. In one embodiment of the invention the output signal is utilized to bring about a corrective adjustment in the position of the metering roller so that the buildup at the nip tends to be restored to optimum level. In another embodiment the output signal sounds an alarm and, if desired, brings the press to a stop so that the situation can be corrected before the applicator cylinder runs dry.

2 Claims, 3 Drawing Figures



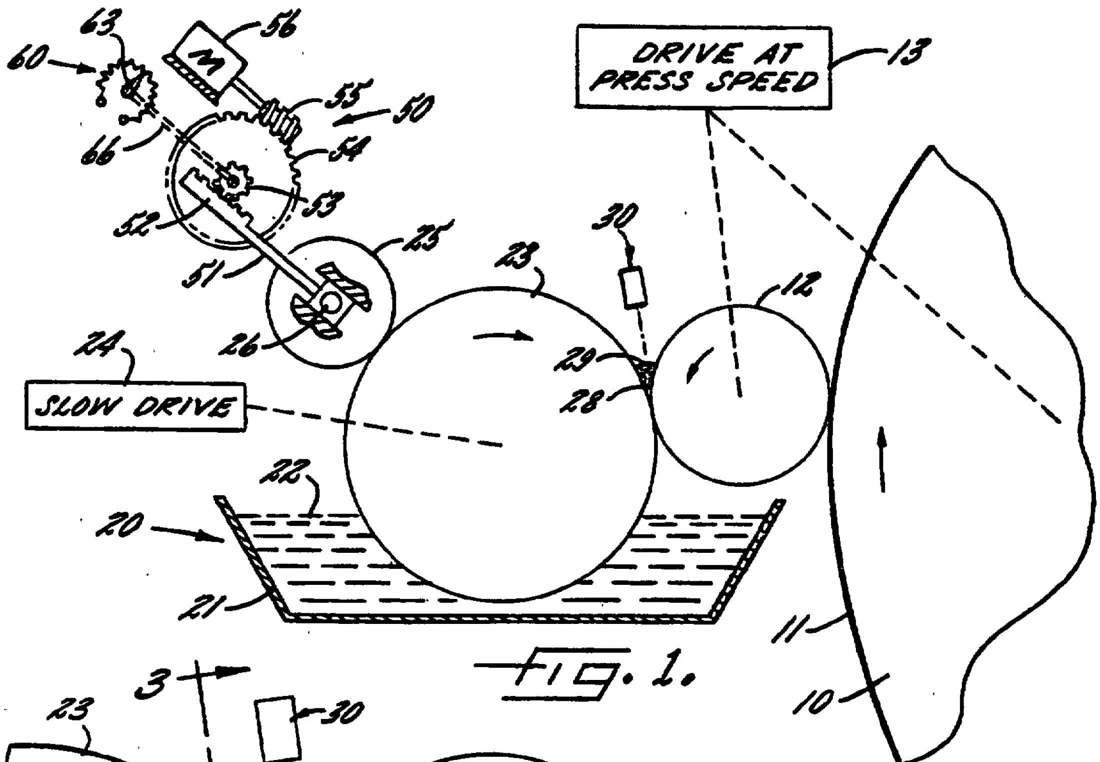


FIG. 1.

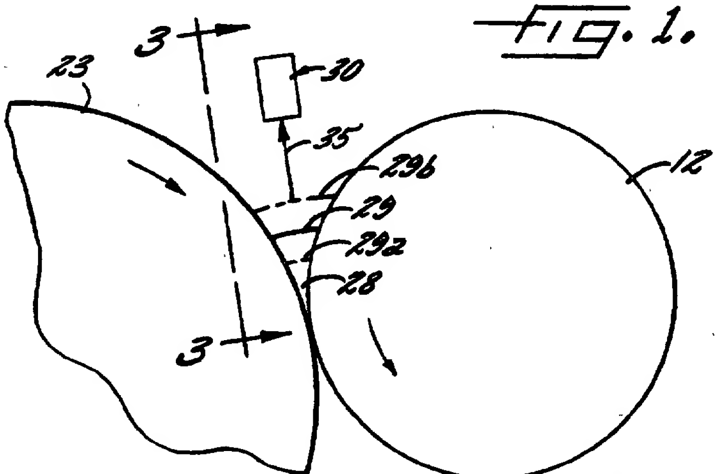


FIG. 2.

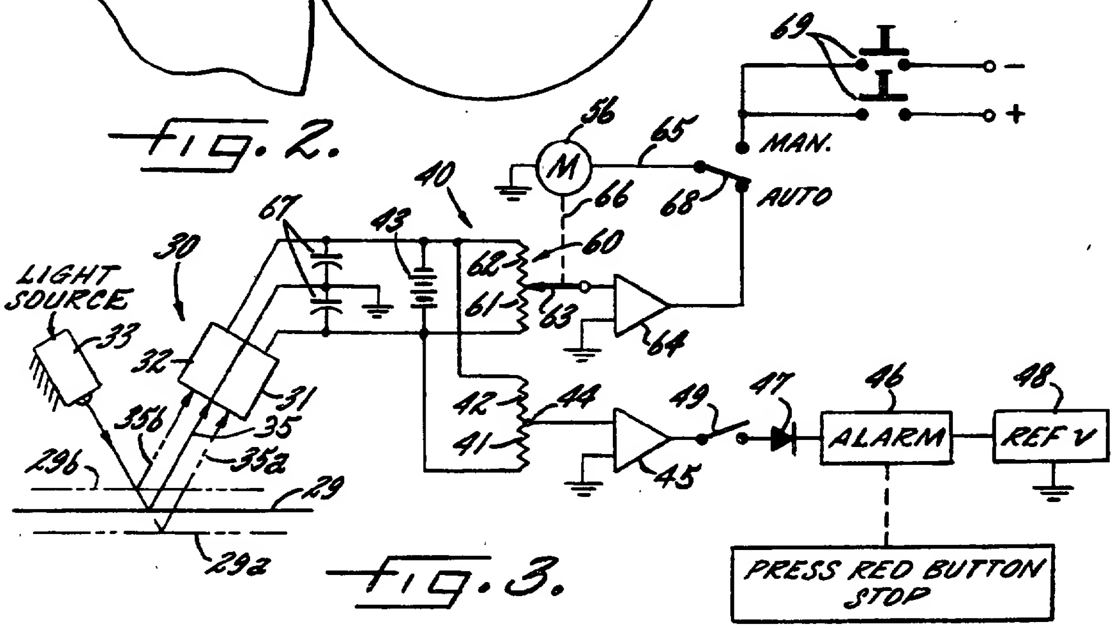


FIG. 3.

DEVICE FOR APPLYING A FLUID, IN PARTICULAR LACQUERS ON PRINTED SHEETS OR CONTINUOUS WEBS

A printing press, in addition to performing its printing function, is often utilized to apply lacquer or other coating material to the sheet. For this purpose an applicator cylinder, having a film of lacquer thereon, engages the face of the sheet as it it supported upon an impression cylinder. For the purpose of furnishing the applicator cylinder with lacquer a "scoop" or fountain roller is partially immersed in a body of lacquer contained in a tray or trough, with the rate of feed being controlled by a metering roller. An applicator roller is interposed between the fountain roller and the applicator cylinder for transfer of the lacquer from the fountain to the cylinder.

The rate of feed of the lacquer must be carefully monitored by the pressman to prevent the applicator cylinder from running dry. Should this occur, the printed material would fail to meet specifications resulting in a loss to the printer.

It is, accordingly, an object of the present invention to provide means including a sensor for monitoring lacquer buildup in a nip in the supply path and for creating an output signal when the buildup departs from an optimum level. It is a related object to provide means responsive to the variation in buildup to produce an output signal which, at the option of the user, (a) sounds an alarm, (b) shuts down the press, or (c) brings about an automatic corrective variation in the rate of feed. It is a more general object of the invention to utilize, as an indicator of feed, the buildup of lacquer or other liquid which occurs at the nip of a pair of counter-rotating rollers in the feed system.

It is another object of the present invention to provide means for monitoring the flow of lacquer or other liquid in a printing press which operates reliably and which is highly economical to install and maintain.

Other objects and advantages of the invention will become apparent upon reading the attached detail description and upon reference to the drawings, in which:

FIG. 1 is a diagram, in elevation, of a lacquer feeding arrangement in a printing press with provision for monitoring the level in a nip and for producing an output signal in accordance with the level of buildup.

FIG. 2 is a fragmentary elevation showing the buildup on an enlarged scale.

FIG. 3, viewed along line 3—3 in FIG. 2, shows a simplified system for detecting the level of buildup and for causing a departure from optimum to (a) sound an alarm, (b) stop the press drive or (c) bring about a corrective change in the rate of feed.

While the invention has been described in connection with certain perferred embodiments, it will be understood that we do not intend to be limited to the embodiments shown but intend, on the contrary, to cover the various alternative forms of the invention included within the spirit and scope of the appended claims.

Turning now to FIG. 1 there is shown an applicator cylinder 10 having a surface 11 which carries a film of lacquer for application to a sheet mounted upon a cooperating impression cylinder (not shown). In rolling engagement with the applicator cylinder is an applicator roller 12, the surfaces of the roller and cylinder being operated at "press speed" by a drive 13.

For the purpose of furnishing lacquer to the applicator cylinder, a fountain 20 is provided having a tray or trough 21 containing a body of the lacquer 22. Partially submerged in the lacquer is a fountain roller 23 which is rotated at slow speed by a drive 24. On the "emerging" or left-hand side of the fountain roller 23 is a metering roller 25 having a shaft 26 which is journalled in a bearing 27. Applicator roller 12 and fountain roller 23, rotating in opposite directions, meet at a nip 28. There tends to accumulate, in the nip, a buildup of lacquer indicated at 29, which buildup has an optimum level, indicating an adequate rate of feed, during normal operation. When the buildup exceeds the optimum condition "runover" tends to occur, and when the buildup is less than optimum there is risk that the applicator cylinder 11 will run dry so that the sheets which are produced will be uncoated and therefore unsalable.

In accordance with the present invention a sensing device is located opposite the nip 28 for constantly monitoring the level of buildup and for producing an output signal, utilized by the pressman, when the buildup departs from optimum. The sensing device, indicated at 30, may take various forms without departing from the invention. For example, the sensing device may be of the optical type as illustrated in FIG. 3 consisting of adjacent photocells 31, 32 illuminated by a light source 33. The light source produces a beam 34 which is specularly reflected from the surface of the buildup along path 35. When the level of buildup 29 is optimum, the light reflected into the photocells 31, 32 will be equal and no output signal will be produced. The level of buildup may fall to the level *29a* which causes the reflective path to switch to position *35a* which favors the photocell 31. Such condition produces an output signal for the sounding of an alarm or the like. Alternatively, the buildup may rise to the level *29b* resulting in a reflection path *35b* which favors the photocell 32. This also produces an output signal which results in corrective action being taken.

In carrying out the invention a bridge circuit is provided for responding to unbalance between the two photocells and for producing an output signal in accordance therewith. This bridge circuit, indicated at 40, has the photocells 31, 32 in its first two legs and resistors 41, 42 in third and fourth legs, respectively. The bridge is energized by a battery 43. Thus, under conditions of unbalance an output signal exists at output terminal 44. The output voltage is amplified by an amplifier 45, the output of which energizes an alarm device 46. An interposed diode 47 ensures that the alarm is sounded only in response to a falling level. The point of triggering of the alarm is determined by including, in series, an adjustable source of reference voltage 48. The alarm circuit is turned on by a switch 49.

In operation, and with the bridge initially balanced, the level is at 29 and there is a complete absence of output signal. However, if for any reason the level at the nip should fall, say to the level *29a*, the photocell 31 is favored as compared to the photocell 32 resulting in an output signal at output terminal 44 which, amplified by amplifier 45 and with favorable polarization at diode 47, the alarm 46 sounds alerting the pressman to check both the rate of feed in the system and the level of the body of lacquer in the tray 21.

If desired, the alarm device 46 may be coupled to the dropout circuit of the press drive 13, as shown in FIG. 3, in such a way that the alarm condition is effective to trigger a "red button stop", bringing the press quickly

to a halt and signifying that corrective action should be urgently taken.

In accordance with one of the aspects of the present invention the output signal from the bridge circuit 40 may be utilized to bring about a corrective change in the rate of feeding of the lacquer by the fountain roller 23. This is brought about by an electro-mechanical servo system 50, the mechanical portion of which is set forth in FIG. 1. Thus, the bearing 27 which supports the shaft of the metering roller 25 is slidably mounted in ways formed in the frame of the machine and positioned by a plunger 51. The plunger 51 is connected to a rack 52 which is driven by a pinion 53 coupled to a gear 54. The latter is rotatable by a worm 55 driven by a reversable motor 56. All that need be said about the motor is that it is capable of driving in opposite directions depending on the polarity of the control signal.

To produce an output signal the bridge 40 is terminated in a potentiometer 60 having legs 61, 62 and a wiper 63. The wiper is connected to the input of an amplifier 64 having an output lead 65 which drives the motor 56. The mechanical output of the motor is coupled by a connection 66 (see also FIG. 1) to the wiper 63 of the potentiometer. Capacitors 67 respectively connected across the photocells 31, 32 have an averaging effect and make the system nonresponsive to transient changes in level and, more particularly, to transient departures from the horizontal.

The servo system is turned on by a switch 68 which is capable, also, of switching push-buttons 69 into the circuit for manual control.

It will be assumed that initially the buildup is horizontal and at the level indicated at 29. It will further be assumed that the bridge, under such conditions, is balanced so that the motor 56 is de-energized. Upon a drop in the level of buildup from 29 to 29*a*, the reflected beam switches to position 35*a* causing more of the reflected light to enter photocell 31 than enters photocell 32. This unbalances the bridge causing an output signal to exist at the bridge terminal 63, which signal is fed to the amplifier 64. The amplified signal is applied, by line 65, to the motor 56 causing the motor to rotate in the direction which produces backing off of the plunger 51 thereby creating additional clearance between the fountain roller 23 and the metering roller 25 allowing lacquer to be transported at a greater rate to the nip 28. At the same time the motor, through connection 66, causes movement of the slider 63 on potentiometer 60 to rebalance the bridge circuit so that the signal fed through the amplifier 64 to the motor 56 is reduced to zero, turning off the motor.

The increased rate of flow of the lacquer causes the buildup to be restored from the low level 29*a* to the optimum level 29. Any tendency of the level to exceed the level 29, causing a rise in the level of buildup to the level 29*b*, results in a switch of the reflected beam to the path 35*b* which causes more light to be transmitted to photocell 32 than is transmitted to photocell 31. This results in an output signal at output terminal 63 of the bridge which is opposite to that previously produced and which, amplified by the amplifier 64, causes the motor 56 to rotate in the opposite direction, that it, in a direction to slightly close down the metering roller 25 reducing the flow of lacquer to the nip 28 and, simultaneously, through connection 66, rebalancing the bridge so that the level of buildup does not substantially exceed the level 29. This constitutes a "hunting" type of control in which the level of buildup swings slightly above and slightly below the optimum level 29 so that the flow of lacquer to the applicator roller and applicator cylinder is, on the average, at an optimum rate.

While the invention has been described in connection with a sensor 30 which works on an optical, or reflective, principle, it will be apparent to one skilled in the art that the invention is not limited thereto and that other sensors 30, arranged opposite the nip 28 for response thereto and capable of producing an output signal which varies in accordance with a departure in buildup from the optimum level, may be substituted without departing from the present invention.

In the arrangement described it is preferable for the fountain, or scoop, roller 23 and the applicator cylinder 11 to be hard surfaced while the applicator roller 12 and metering roller 25 are resiliently surfaced.

Although the invention has been described in connection with a highly simplified arrangement in which there is direct transfer of lacquer from the fountain, or scoop, roller 23 to the counter-rotating applicator roller 12, to produce the buildup 29, it will be understood that the invention is not limited to such simplified form and, if desired, additional roller may be interposed between the fountain roller and applicator roller and driven at a surface speed corresponding to one of them, for creation of a nip having a region of buildup which is monitored by a sensing device 30 as described.

The term "signalling means" as used herein refers to any means capable of attracting the attention of the pressman or for bringing about a corrective change in the rate of feed.

We claim:

1. In a printing press the combination comprising an applicator cylinder for receiving a film of lacquer from an associated counterrotating applicator roller, means for driving the cylinder and applicator roller at press speed, a fountain supplying the lacquer and having a fountain roller partially immersed in a reservoir of lacquer disposed below said fountain roller, means for driving the fountain roller so that it picks up a coating of lacquer from said reservoir, said fountain roller engaging the applicator roller so that some of the lacquer is transferred from the fountain roller to the applicator roller, a metering roller engaging the fountain roller, means for adjusting the transaxial spacing between the metering roller and the fountain roller so that a film of regulated thickness is applied to and transferred by the applicator roller, said fountain roller driving means being operable to drive said fountain roller in a counterrotative direction with respect to the applicator roller with the contacting applicator roller and cylinder surfaces being rotated upwardly at the nip between the applicator roller and the cylinder so that there is no significant buildup of lacquer at the nip between the applicator roller and the cylinder and with the contacting fountain roller and applicator roller surfaces being rotated downward at the nip between the fountain roller and the applicator roller so that the lacquer tends to buildup at the nip between the fountain roller and the applicator roller, the engagement of the fountain roller and the applicator roller causing a desired thickness of lacquer to be transferred to the cylinder when the buildup of lacquer is at an optimum level in the nip between the fountain roller and applicator roller, means including a sensing device located at the nip between the fountain roller and applicator roller for sensing said buildup of lacquer and for producing an output signal upon departure of the buildup from an optimum level,

and means responsive to an input signal from the sensing device for acting upon the adjusting means to bring about a corrective adjustment in the position of the metering roller with respect to the fountain roller so

that said lacquer buildup in the nip tends to be restored to the optimum level.

2. The combination as claimed in claim 1 further comprising means responsive to the sensing device for emitting a warning signal when the fluid buildup drops substantially below the optimum level.

* * * * *

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United States Patent [19]

Matsuno et al.

[11] **Patent Number:** **4,501,223**

[45] **Date of Patent:** **Feb. 26, 1985**

[54] **COATING APPARATUS**

[75] Inventors: **Sadayuki Matsuno**, Yokohama; **Hiroshi Itoh**, Tokyo; **Isamu Nishikawa**, Yokohama; **Tatsuo Awazu**, Zushi; **Toshio Matsunaga**, Tokyo; **Yoshitaka Kitaoka**; **Goro Sugimoto**, both of Yokohama; **Hiroki Nishinaka**, Amagasaki, all of Japan

[73] Assignee: **Hitachi Zosen Corporation**, Japan

[21] Appl. No.: **591,400**

[22] Filed: **Mar. 21, 1984**

[30] **Foreign Application Priority Data**

Nov. 30, 1983 [JP] Japan 58-227742
Nov. 30, 1983 [JP] Japan 58-227743

[51] **Int. Cl.**[3] **B05C 7/00**

[52] **U.S. Cl.** **118/668**; 118/305; 118/323

[58] **Field of Search** 118/668, 305, 323

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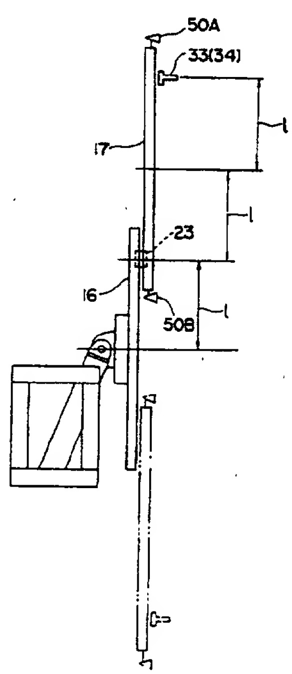
Primary Examiner—Shrive P. Beck
Attorney, Agent, or Firm—Barnes, Kisselle, Raisch, Choate, Whittemore & Hulbert

[57] **ABSTRACT**

A coating apparatus comprising a support assembly, a support moving mechanism for pivotally moving the support assembly about a horizontal axis, an applicator supported by the support assembly upwardly and downwardly movably, a position detector for detecting the raised or lowered position of the applicator, a pair of distance sensors attached to the support assembly and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and a control unit connected to the position detector and to the distance sensors for causing the support moving mechanism to pivotally move the support assembly in response to detection signals from one of the distance sensors closer to the applicator to hold the applicator at a substantially constant distance from the work surface. Even when curved in the direction of the height, the work surface can be coated uniformly because the substantially constant distance is maintained between the applicator and the work surface.

6 Claims, 12 Drawing Figures



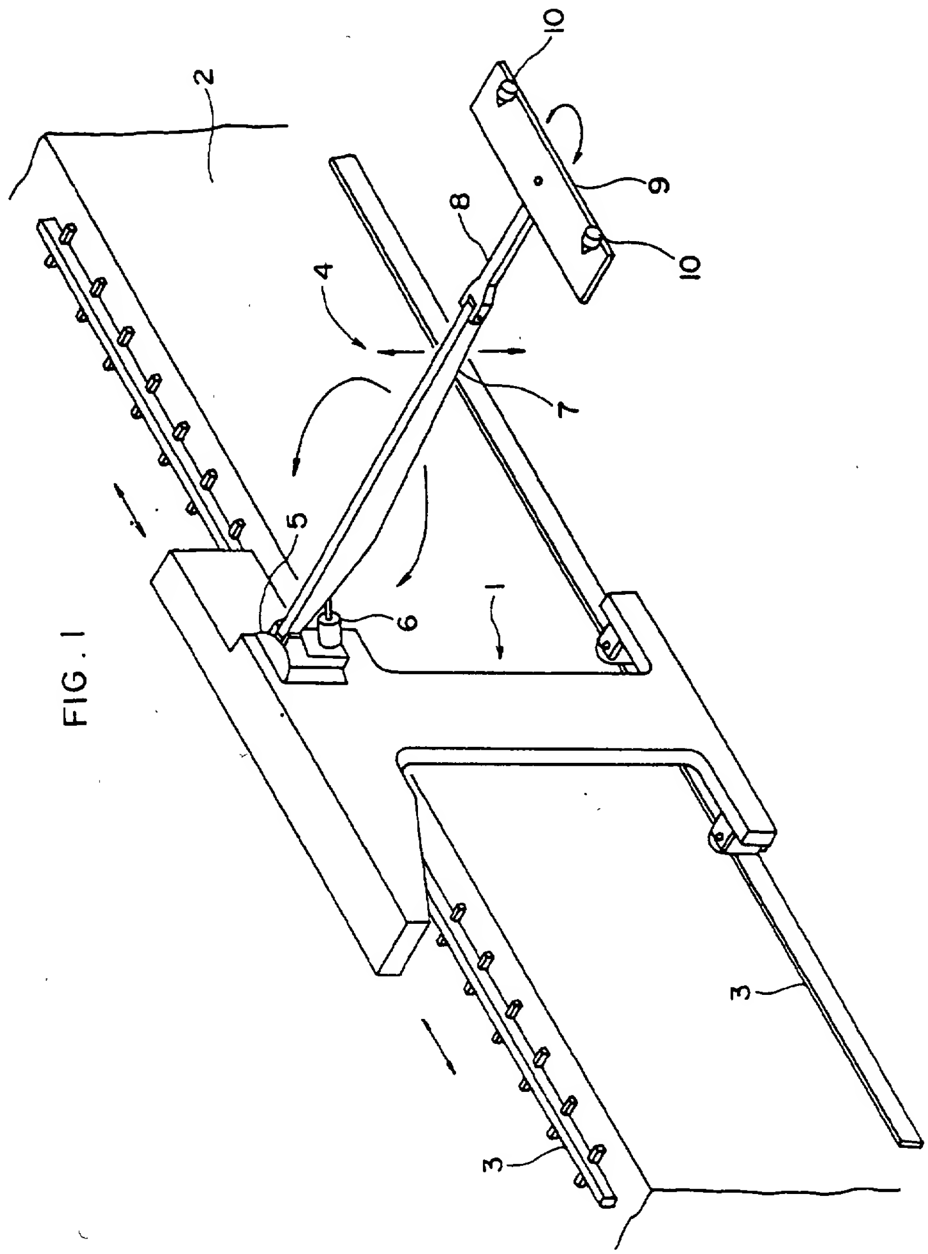
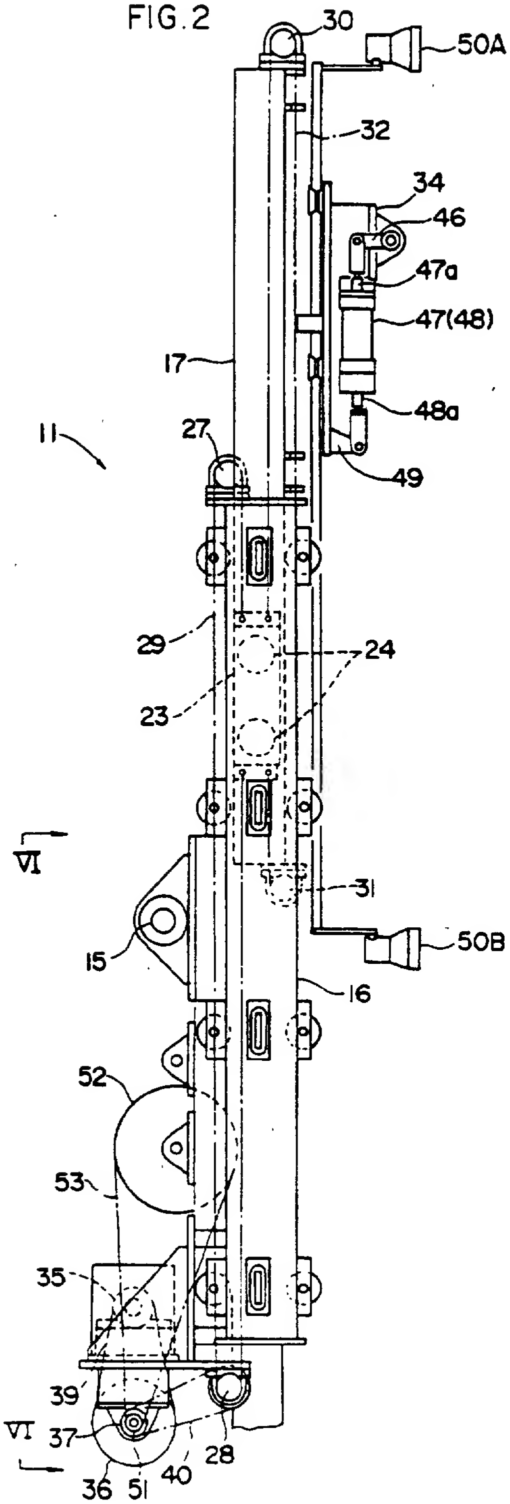


FIG. 1

FIG. 2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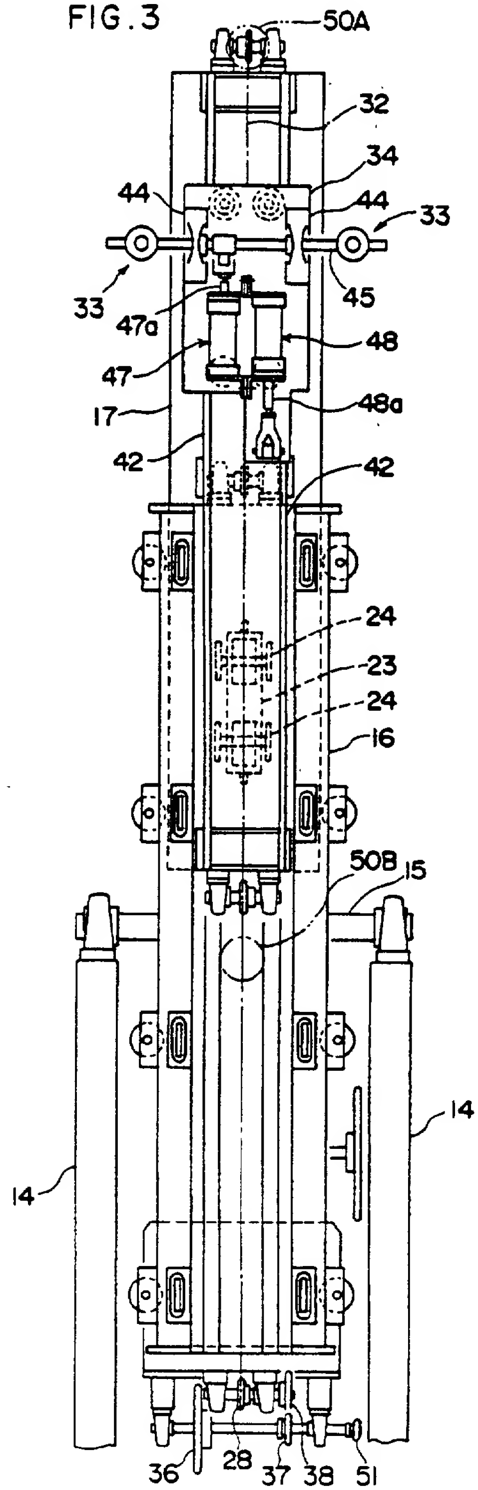
50A
32
34
46
47a
47(48)
17
48a
11
27
49
29
24
23
VI
31
15
50B
16
52
53
35
39
VI
37
28
40
36
51

FIG. 3


50A
32
34
44
44
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33
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47a
48
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48a
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50B
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FIG. 4

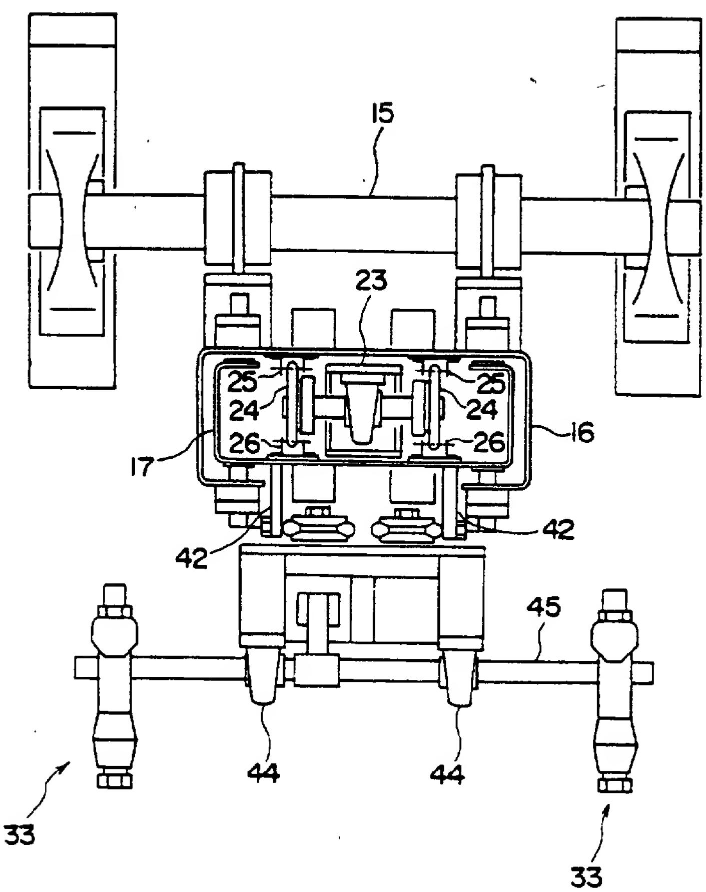


FIG. 5

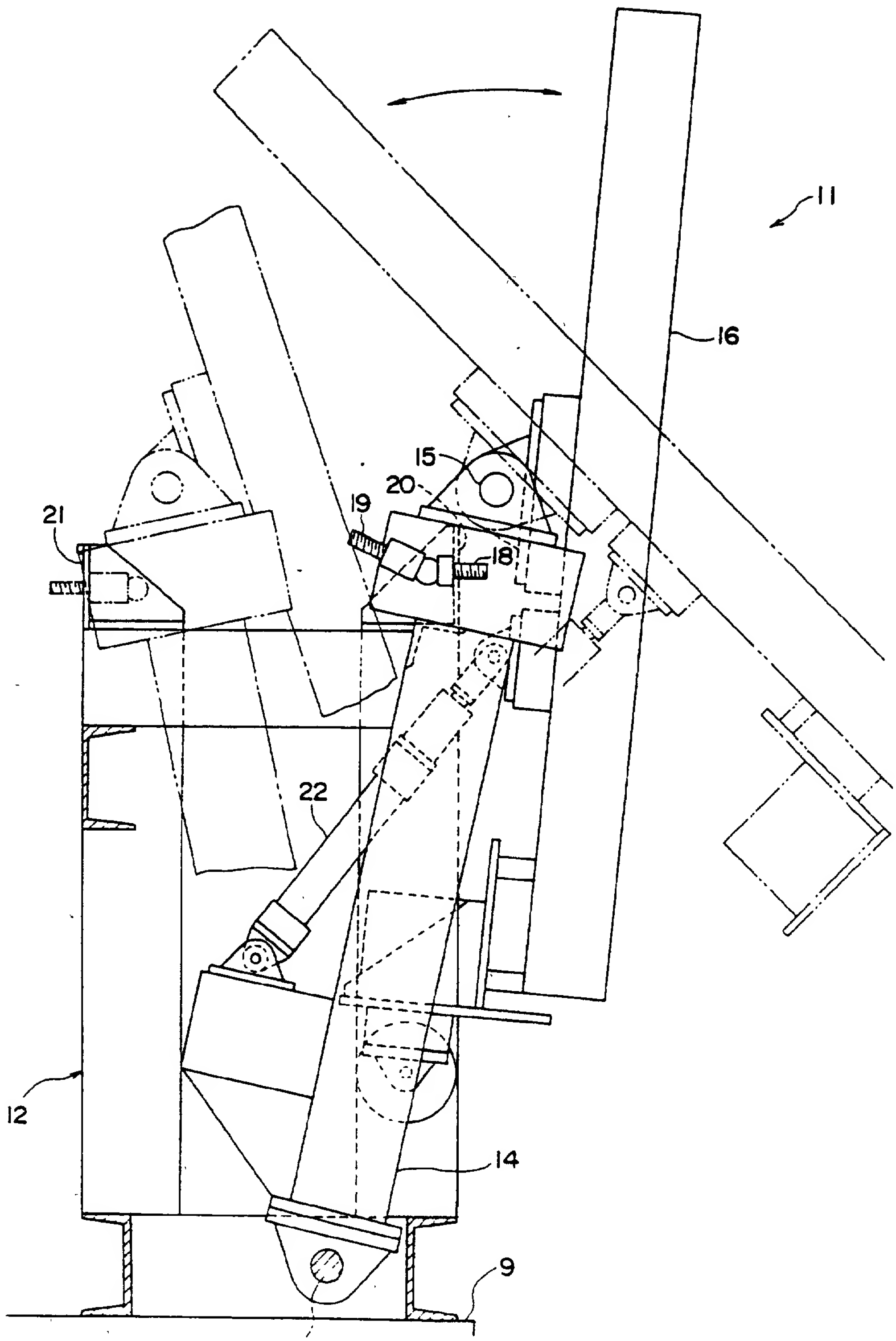


FIG. 6

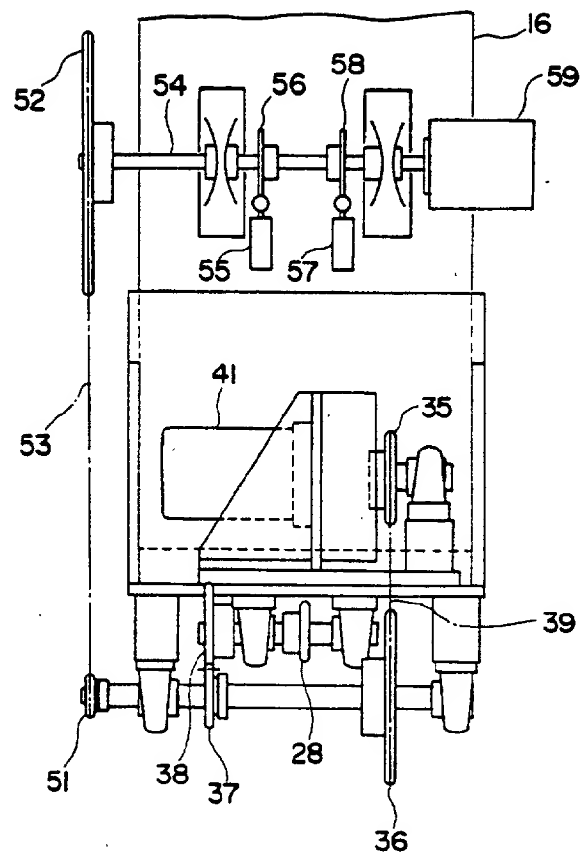
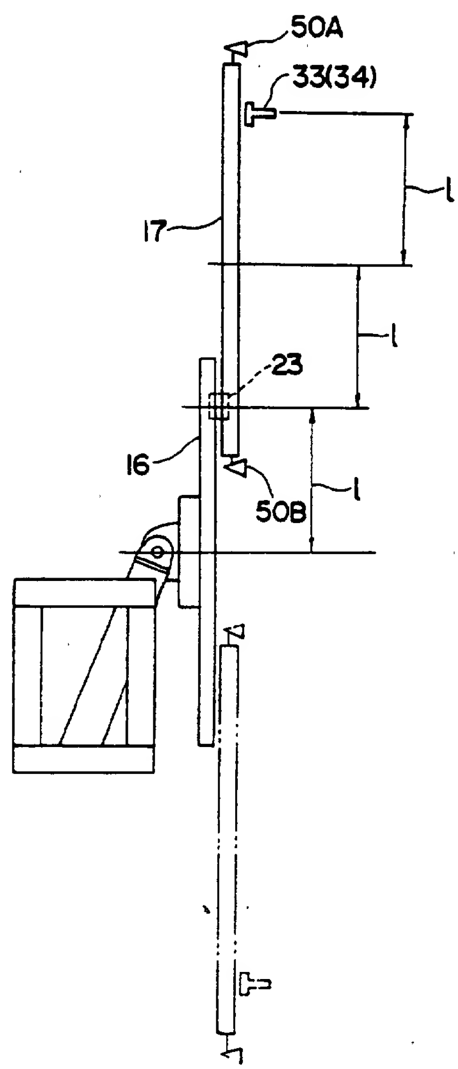


FIG.7



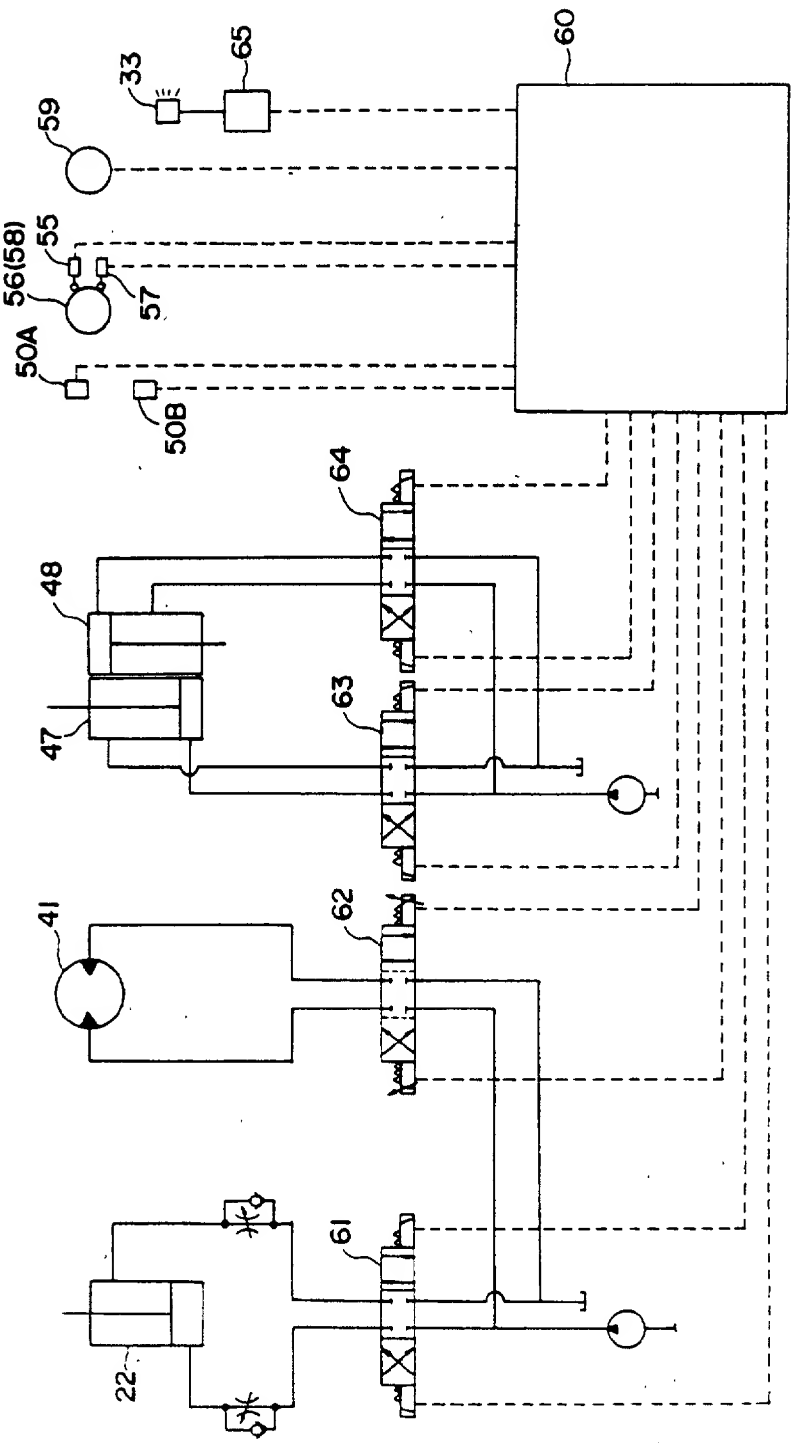


FIG. 8

FIG. 9

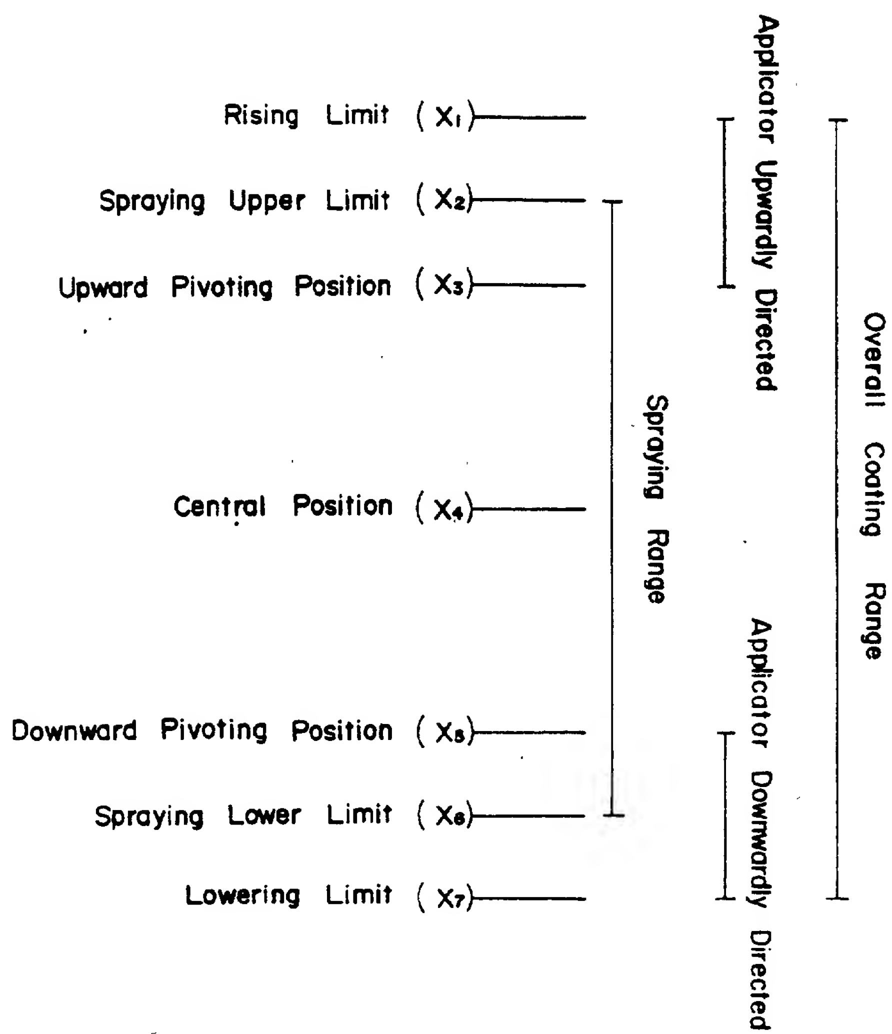
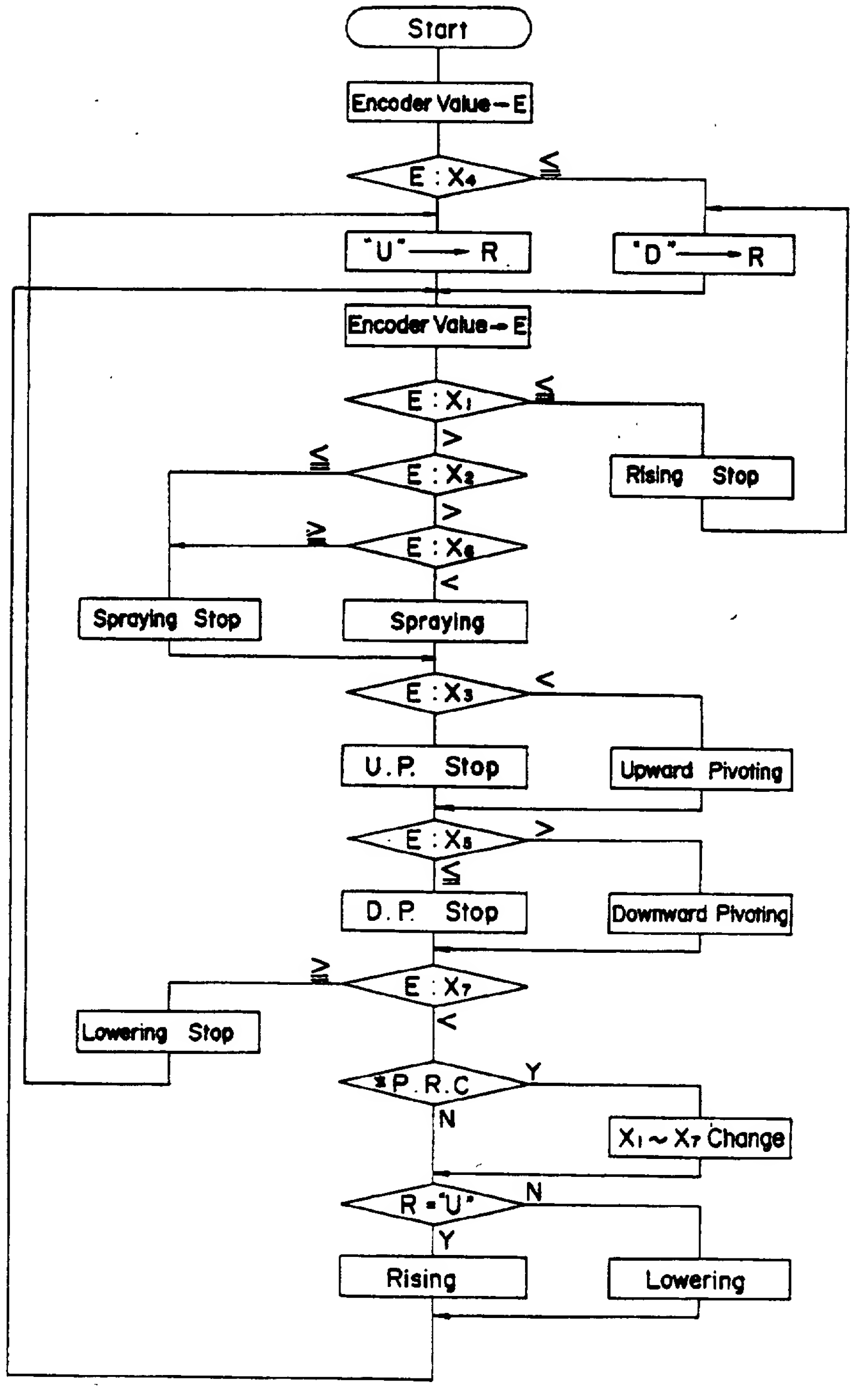

Rising Limit (X1)
Spraying Upper Limit (X2)
Upward Pivoting Position (X3)
Central Position (X4)
Downward Pivoting Position (X5)
Spraying Lower Limit (X6)
Lowering Limit (X7)
Spraying Range
Applicator Upwardly Directed
Applicator Downwardly Directed
Overall Coating Range

FIG.10



* Coating Range Change

FIG. 11

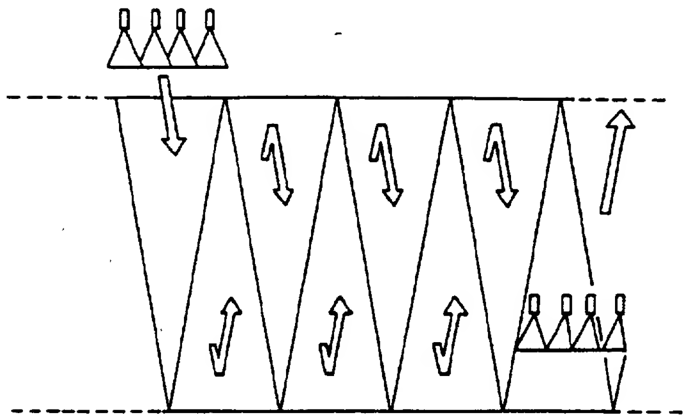
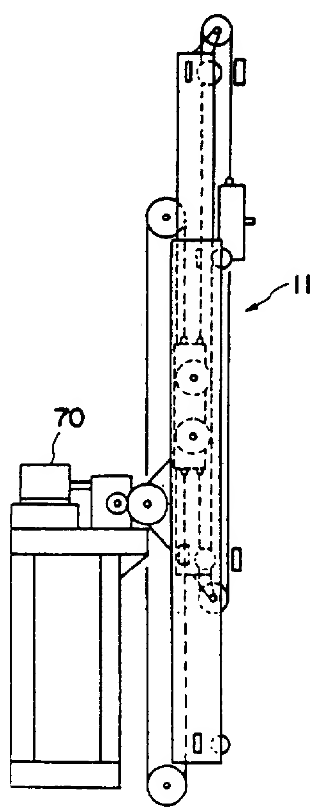


FIG. 12



COATING APPARATUS

The present invention relates to a coating apparatus, and more particularly to a coating apparatus suitable for applying a coating composition to the shell plating of ships during docking.

Laid-Open UK patent application GB 2110647A discloses a coating apparatus including support means which is mounted on a running truck horizontally movable along the surface to be treated and which supports an applicator upwardly or downwardly movably. The support means is pivotally movable about a horizontal axis by a device which is controlled by an operator, whereby the applicator can be held somewhat at a constant distance from the work surface which is curved in the direction of height. While being reciprocated between an upper limit position and a lower limit position, the applicator sprays a coating composition onto the work surface for coating.

However, because the support means moving device is operated by the worker, the known coating apparatus requires skill in holding the applicator at a constant distance from the work surface, while even a skilled worker has difficulties in maintaining the constant distance at all times between the work surface and the applicator which is continuously moved upward and downward, thus failing to assure uniform coating.

An object of the present invention is to provide an apparatus by which even curved surfaces can be coated uniformly and full-automatically.

To fulfill this object, the present invention provides a coating apparatus comprising support means, support moving means for pivotally moving the support means about a horizontal axis, an applicator holder supported by the support means upwardly and downwardly movably and supporting applicator means, holder drive means for moving the applicator holder upward and downward, position detecting means for detecting the raised or lowered position of the applicator holder or the applicator means, a pair of distance detecting means attached to the support means and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and control means connected to the position detecting means and to the distance detecting means for causing the support moving means to pivotally move the support means in response to detection signals from one of the distance detecting means closer to the applicator means to maintain a substantially constant distance between the applicator means and the work surface.

Various features and advantages of the present invention will be readily understood from the embodiments to be described below with reference to the accompanying drawings, in which:

FIG. 1 is an overall perspective view showing a coating apparatus embodying the invention;

FIG. 2 is a side elevation showing support means included in the coating apparatus and provided with an applicator;

FIG. 3 is a front view showing the support means;

FIG. 4 is a plan view of the support means;

FIG 5 is a fragmentary enlarged view of the support means;

FIG. 6 is a view showing the support means as it is seen in the direction of line VI—VI in FIG. 2;

FIG. 7 is a diagram for illustrating the upward or downward movement of the applicator;

FIG. 8 is a diagram showing the control circuit of the coating apparatus;

FIG. 9 is a diagram showing operating positions of the applicator;

FIG. 10 is a flow chart showing a control process for coating operation;

FIG. 11 is a diagram showing coating cycles; and

FIG. 12 is a fragmentary side elevation showing another embodiment of the invention.

With reference to FIG. 1, a truck 1 is adapted to run horizontally alongside a hull in a dock over the entire length of the hull by being guided by upper and lower rails 3 extending along a side wall 2 of the dock. The running truck 1 is provided with a crane 4. The crane 4 comprises a rotary support 5 mounted on an upper portion of the truck 1 and rotatable about a vertical axis, a pivotal arm 7 supported by the rotary support 5 and pivotally movable about a horizontal axis by a hydraulic cylinder 6, and a rotatable plate 9 supported by a horizontal arm 8 which is held always in a horizontal position to the free end of the pivotal arm 7, the plate 9 being rotatable about a vertical axis. Ultrasonic sensors 10 mounted on opposite ends of the rotatable plate 9 are used for causing the plate 9 to follow the horizontal curve of the outer side surface of the hull.

With reference to FIGS. 2 to 8, support means 11 is mounted on the rotatable plate 9. The support means 11 chiefly comprises a pair of pivotal rods 14 rotatably attached by a horizontal pivot 13 to opposite sides of the lower end of a frame 12 fixedly mounted on the rotatable plate 9, a first support member 16 rotatably connected to the free ends of the pivotal rods 14 by a horizontal pivot 15 and in the form of a channel member which is elongated generally vertically, and a second support member 17 supported by the first support member 16 movably longitudinally thereof and similarly in the form of a channel member which is elongated generally vertically.

Each of the pivotal rods 14 is fixedly provided at its upper end with a front bolt 18 and a rear bolt 19 which extend away from each other. When the front bolt 18 is inserted through a hole formed in a front bracket 20 at the upper end of the frame 12, with an unillustrated nut screwed on the bolt, the pivotal rod 14 can be retained in a forwardly inclined position (shown in solid lines in FIG. 5). When the rear bolt 19 is inserted through a hole formed in a rear bracket 21 at the upper end of the frame 12, with an unillustrated nut screwed on the bolt, the pivotal rod 14 can be held in a rearwardly inclined position (shown in phantom lines in FIG. 5).

A hydraulic cylinder 22 is provided between the pivotal rod 14 and the first support member 16. The first support member 16 is pivotally movable with the second support member 17 by operating the hydraulic cylinder 22.

A movable member 23 is provided between the first support member 16 and the second support member 17 and has engaging wheels (such as sprockets) 24. First and second engaging rails 25, 26 are attached to the opposed faces of the support members 15, 16, respectively. The engaging wheels 24 on the movable member 23 are in engagement with these rails 25, 26. Connected to opposite ends of the movable member 23 are a first roller chain 29 which is reeved around sprockets 27, 28 mounted on opposite ends of the first support member 16 and a second roller chain 32 which is reeved around sprockets 30, 31 on opposite ends of the second support member 17. The second roller chain 32 is connected

also to an applicator holder 32 carrying applicators 33. The sprocket 28 at the lower end of the first support 16 is coupled through sprockets 35 to 38 and chains 39, 40 to a hydraulic motor 41 fixed to the first support member 16. Accordingly when the motor 41 moves the movable member 23 a distance l relative to the first support member 16 as seen in FIG. 7, the second support member 17 moves the same distance l in the same direction relative to the movable member 23, and at the same time, the holder 34, i.e., the applicator 33 attached thereto, move the same distance l in the same direction relative to the second support member 17. In other words, the applicators 33 move three times the distance of movement of the movable member 23.

The holder 34 is movable along a pair of guide rails 42 fixed to the second support member 17. The applicators 33 (such as spray guns for a coating composition) are fixed to a horizontal rotary shaft 45 supported by bearings 44 on the holder 34. A first air cylinder 47 has a piston rod 47a which is connected to the rotary shaft 45 by a link 46. Fixed to the first air cylinder 47 is a second air cylinder 48 having a piston rod 48a which extends in a direction opposite to the piston rod 47a. The piston rod 48a is rotatably connected to a bracket 49 on the holder 34. The applicators 33 are adapted to be brought to their pivoted central position when the piston rod 47a of the first air cylinder 47 is retracted, with the piston rod 48a of the second air cylinder 48 extended. Accordingly, when the piston rod 47a of the first cylinder 47 is extended, the applicators 33 are pivoted downward, while the retraction of the piston rod 48a of the second cylinder 48 pivotally moves the applicators 33 upward.

Upper and lower ultrasonic sensors 50A, 50B for detecting the distance from the side outer surface of the hull (work surface to be coated) are attached to the upper and lower ends of the second support member 17.

Further as seen in FIG. 6, the first support member 16 is provided with an input shaft 54 which is coupled through sprockets 51, 52 and a chain 53 to the hydraulic motor 41 for moving the movable member 23 upward or downward. The sprocket 51 is driven by the motor 41 through the sprockets 35, 36 and chain 39. Mounted on the midportion of the input shaft 54 are a first cam plate 56 for actuating a first limit switch 55 for detecting that the applicators 33 are positioned above the central position in the range of travel thereof, and a second cam plate 58 for actuating a second limit switch 57 for detecting that the applicators 33 are below the central position. A rotary encoder 59 is mounted on one end of the input shaft 54 for detecting the position of the applicator 33 during the travel thereof.

As seen in FIG. 8, the signals from the sensors 50A, 50B, the limit switches 55, 57 and the encoder 59 are all fed to a central processing unit (CPU) 60. In response to such signals, the CPU 60 controls the hydraulic cylinder 22, hydraulic motor 41, air cylinder 47 and air cylinder 48 via electromagnetic change-over valves 61 to 64, respectively, and also controls a coating composition feeder 65 for the applicators 33

With the coating apparatus of the above construction, the first support member 16, namely, the support means 11, is controlled by the hydraulic cylinder 22 in the following manner. The first and second limit switches 55, 57 feed signals to the CPU 60, which checks whether the applicators 33 are positioned above or below the central position of the path of travel thereof. For example when the applicators 33 are positioned

above the central position, the distance signal from the first sensor 50A is compared with a preset distance value. For example if they are found to be away from the hull side outer surface by too large a distance, a signal is given to the electromagnetic change-over valve 61 of the cylinder 22 to bring the first sensor 50A, i.e., the applicators 33, to a position at the preset distance from the outer surface, whereby the means 11 is inclined forward. If the applicators 33 are positioned too close to the hull outer surface, a signal is of course delivered to the valve 61 for moving them away from the hull. Further when the applicators 33 are located below the central position, the second sensor 50B functions to control the support means in the same manner as above. In this way, a substantially constant distance is maintained between the applicators 33 and the side outer surface of the hull over the entire path of travel of the applicators. This eliminates irregularities in the coating that could result from variations in the spraying distance.

The pivotal movement of the applicators 33 is controlled in the manner to be described below with reference to FIG. 9. Along the path of upward-downward movement of the applicators 33, rising limit position, spraying upper limit position, upward pivoting position, central position, downward pivoting position, spraying lower limit position and lowering limit position are set for the applicators from above downward in the order mentioned. Encoded values corresponding to these positions are stored in a memory of the CPU 60 as X1 to X7. Under the control of the CPU 60, a coating composition is sprayed from the applicators 33 within the range of X2 to X6. Between X1 and X3, the applicators 33 are directed upward within an upward angular range of 45 degrees. Between X5 and X7, the applicators 33 are directed upward within a downward angular range of 45 degrees. The applicators 33 are operated in this mode by controlling the hydraulic motor 41, the air cylinders 47, 48 and the composition feeder 65. Accordingly, between X2 and X3, as well as between X5 and X6, the coating composition is sprayed from the applicators 33 while they are being pivoted at all times. The coating composition is therefore applicable uniformly over the entire coating range without producing any coat of increased thickness in the vicinity of the rising upper limit position or the lowering limit position.

Actual coating sequence will be described below chiefly with reference to FIGS. 9 and 10. When the start button (not shown) is depressed, an encoder value E representing the position where the applicators 33 are then located is fed to the CPU 60 and compared with X4. If the encorder value E is greater than X4, i.e., if the applicators are positioned below the central position, an instruction for lowering mode D is set in a register R in the CPU 60, causing the applicator 33 to start lowering. When the position of the applicators 33, i.e., the encorder value E, is in the range of X2 to X6, a signal is given to the feeder 65 to initiate application of the coating composition. During the descent of the applicators 33, the encoder value E matches X5, whereupon the CPU 60 feeds to the first air cylinder 47 a signal for pivoting the applicators 33 downward. The applicators 33 are pivotally moved downward from the usual coating posture. When the encoder value E thereafter matches X6, a coating intrruption signal is sent to the feeder 65 to discontinue the coating operation. The applicators 33 further reach the lowering limit position, with a match between the encoder value E and X7,

whereupon a stop signal is emitted to discontinue the decent and downward pivotal movement of the applicators 33. The mode now changes to rising mode U, whereupon the applicators 33 start to rise and are pivoted upward by the first air cylinder 47 (although still directed downward). When the encoder value E becomes identical with X6, coating operation is resumed. As the applicators 33 further rise, the encoder value E matches X5. The applicators 33 are returned to the usual coating posture and brought out of pivotal movement. In this state, the applicators 33 rise to the position of X3 while spraying the composition. At the position of X3, the CPU 60 emits a signal for operating the second cylinder 48, initiating the applicators 33 into upward pivotal movement. At the position of X2, the coating operation is discontinued, and at the position of X1, the applicators 33 stop rising and moving pivotally upward. The applicators 33 thereafter start to descend again in the same manner as above for continual coating operation. While the applicators 33 move upward and downward in reciprocation, the truck 1 (FIG. 1) carrying the support means 11 on the crane 4 continuously moves horizontally. Accordingly the applicators 33 spray the composition in a zigzag fashion as seen in FIG. 11 (showing four spray guns).

Based on the distance measured by the sensors 10 (FIG. 1), the applicators 33 are caused to follow the curve of the outer surface of the hull longitudinally thereof by the crane 4, which is controlled of course by the CPU 60 or other control means connected to the CPU 60.

The support means 11 may be pivoted by a hydraulic or electric stepping motor 70 as shown in FIG. 12.

What is claimed is:

1. A coating apparatus comprising support means, support moving means for pivotally moving the support means about a horizontal axis, an applicator holder supported by the support means upwardly and downwardly movably and supporting applicator means, holder drive means for moving the applicator holder upward and downward, position detecting means for detecting the raised or lowered position of the applicator holder or the applicator means, a pair of distance detecting means attached to the support means and arranged one above the other at a distance for detecting the distance from the work surface to be coated, and control means connected to the position detecting means and to the distance detecting means for causing the support moving means to pivotally move the support means in response to detection signals from one of the distance detecting means closer to the applicator means to maintain a substantially constant distance between the applicator means and the work surface.

2. A coating apparatus as defined in claim 1 wherein the applicator means is mounted on the holder and pivotable about a horizontal axis by applicator pivoting means, the control means being adapted to cause the pivoting means to pivotally move the applicator means upward upon the applicator means reaching a predetermined raised position and to cause the pivoting means to pivotally move the applicator means downward upon the applicator means reaching a predetermined lowered position.

3. A coating apparatus as defined in claim 1 wherein the position detecting means comprises a rotary encoder coupled to the holder drive means.

4. A coating apparatus as defined in claim 1 wherein the support means comprises a first support member elongated in the upward-downward direction and having first engaging rail means and a second support member supported by the first support member movably longitudinally thereof and having second engaging rail means in opposed relation to the first engaging rail means, the applicator means being supported by the second support member upwardly and downwardly movably, the holder drive means including a movable member having engaging wheel means engageable with the two rail means without sliding, means for moving the second support member relative to the movable member by moving the movable member relative to the first support member and means for converting the movement of the second support member relative to the movable member to a movement, equivalent thereto in distance and direction, of the applicator means relative to the second support member.

5. A coating apparatus as defined in claim 1 wherein the support means is attached by a crane to a running truck movable horizontally, and the crane comprises a rotary support mounted on the running truck rotatably about a vertical axis, a pivotal arm having one end supported by the rotary support rotatably about a horizontal axis and pivotally movable by cylinder means, a horizontal arm connected at its one end to the other end of the pivotal arm rotatably about a horizontal axis and held in a horizontal position at all times and a rotatable plate connected to the other end of the horizontal arm rotatably about a vertical axis and having the support means mounted thereon.

6. A coating apparatus as defined in claim 5 wherein the rotatable plate is provided at its opposite ends with a pair of distance detecting means for detecting the distance between the rotatable plate and the work surface.

* * * * *

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United States Patent [19]

Ito

[11] **Patent Number: 4,524,712**

[45] **Date of Patent: Jun. 25, 1985**

[54] **VARNISH COATER FOR PRINTED PRODUCT**

[75] Inventor: **Kiyoshi Ito, Chiba, Japan**

[73] Assignee: **Komori Printing Machinery Co., Ltd., Tokyo, Japan**

[21] Appl. No.: **576,219**

[22] Filed: **Feb. 2, 1984**

[30] **Foreign Application Priority Data**

Feb. 3, 1983 [JP] Japan 58-16602

[51] **Int. Cl.³** **B05C 1/02**

[52] **U.S. Cl.** **118/46**; 118/249; 118/236; 118/262; 101/352

[58] **Field of Search** .... 118/46, 203, 262, 696, 118/699, 704, 249, 236; 101/350, 351, 352, 416 B

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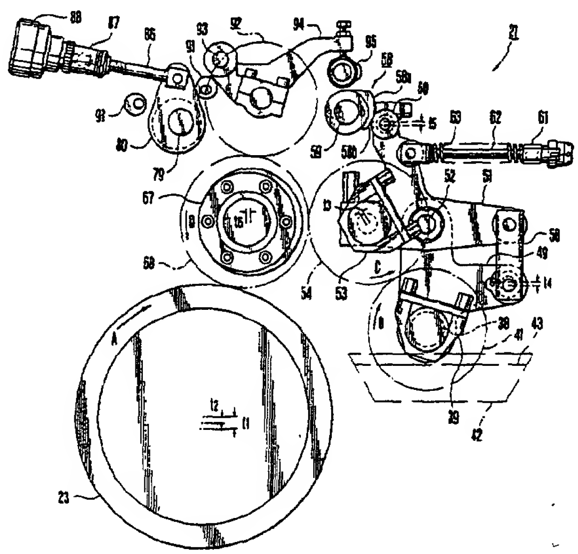
Attorney, Agent, or Firm—Blakely, Sokoloff Taylor & Zafman

[57] **ABSTRACT**

In a varnish coater for a printed product, a blanket cylinder and a form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/off the form roller with respect to the blanket cylinder, and rollers provided in the eccentric bearings of the form roller are brought by biasing means into tight contact with the cam surfaces of cams pivoted by pivot means so as to simplify adjustment of a contact pressure of the form roller with respect to the blanket cylinder at the throw-on and -off positions of the blanket cylinder.

5 Claims, 6 Drawing Figures



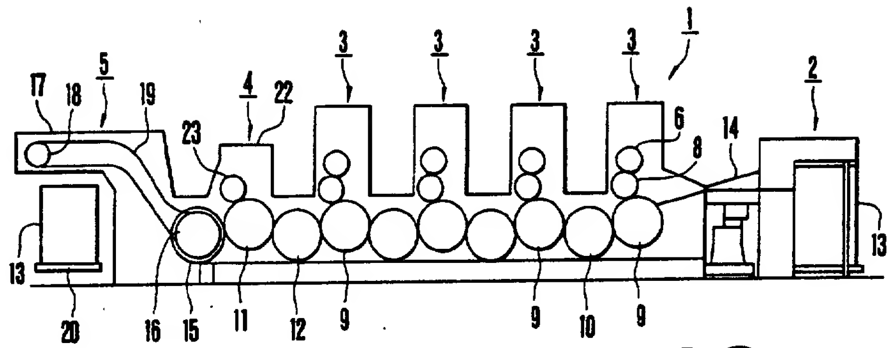

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FIG.1

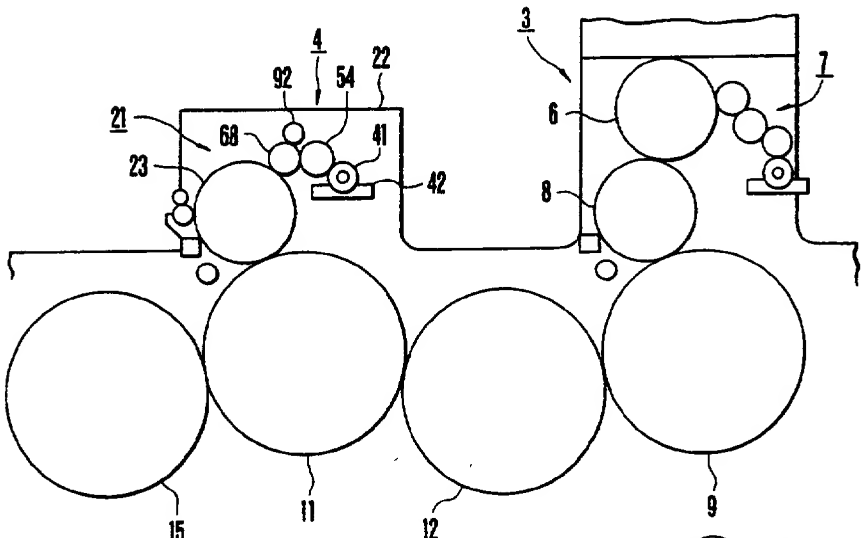
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FIG.2

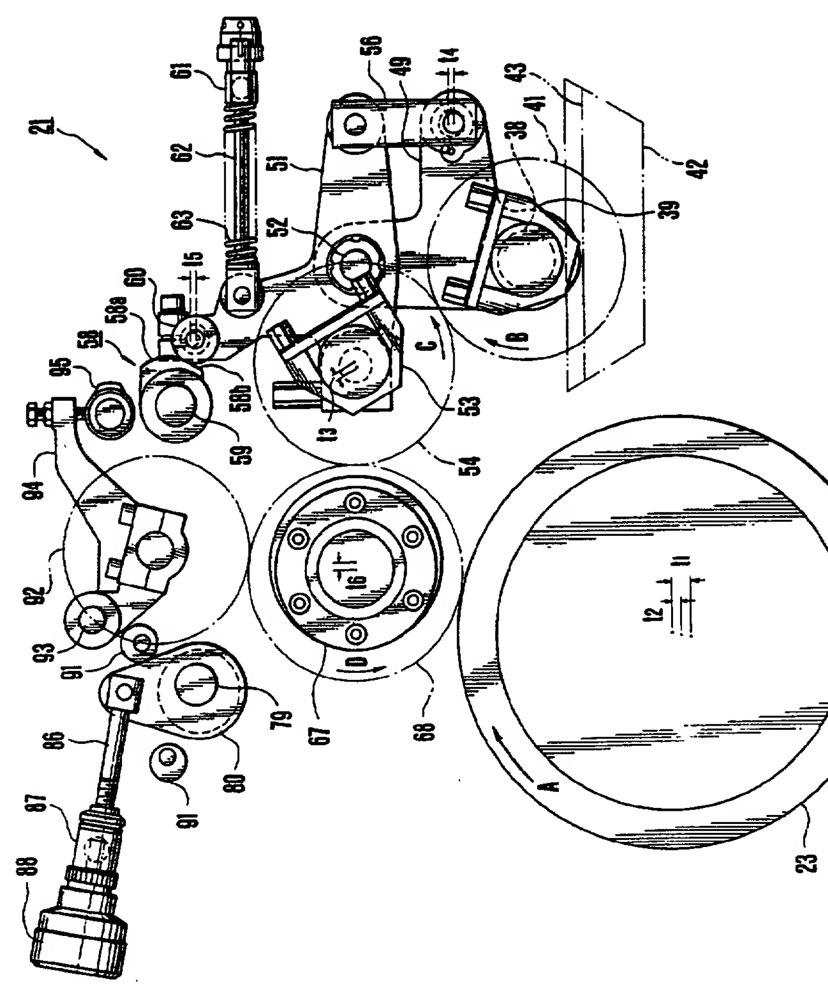
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FIG.3

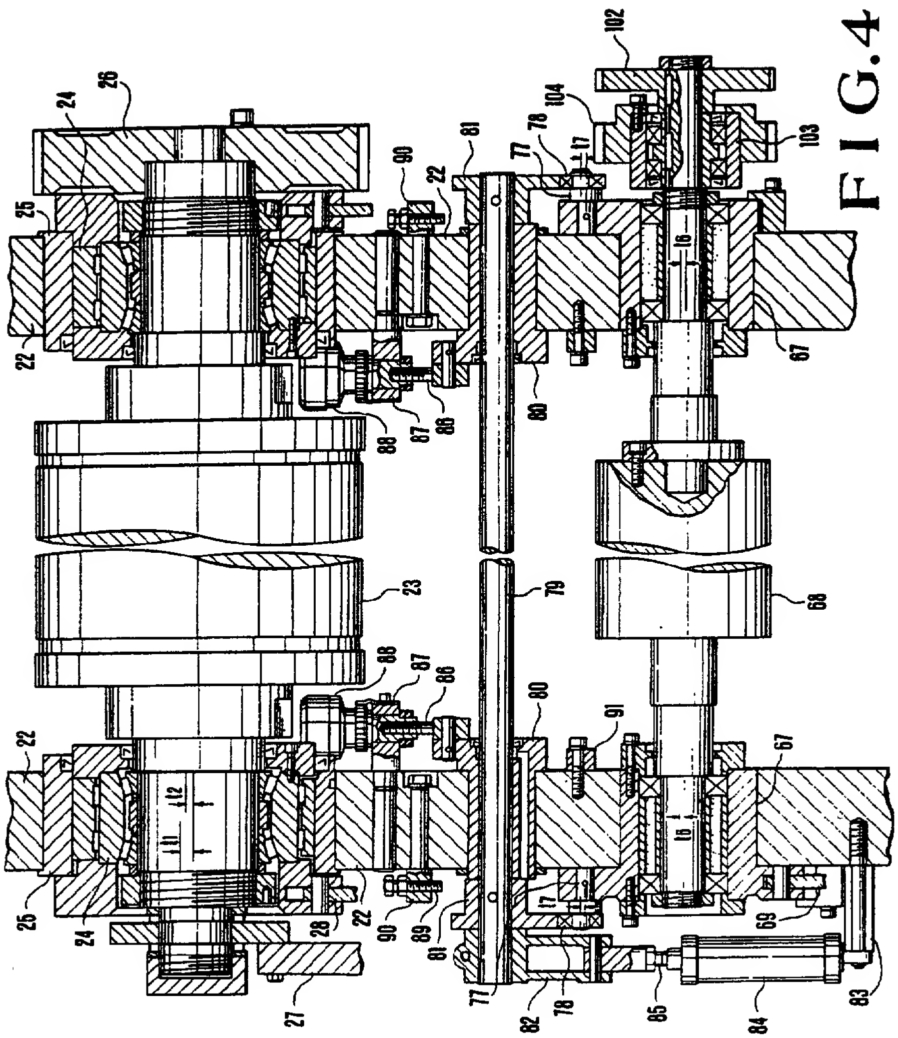


FIG. 4

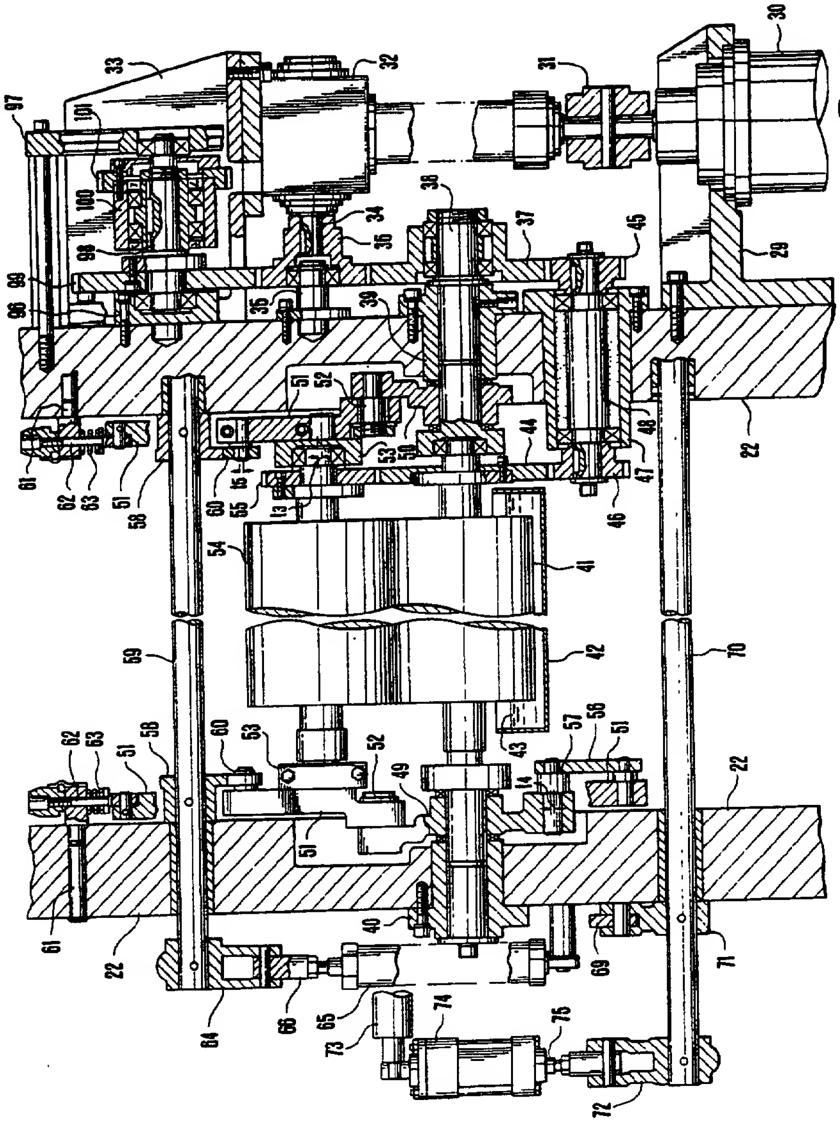
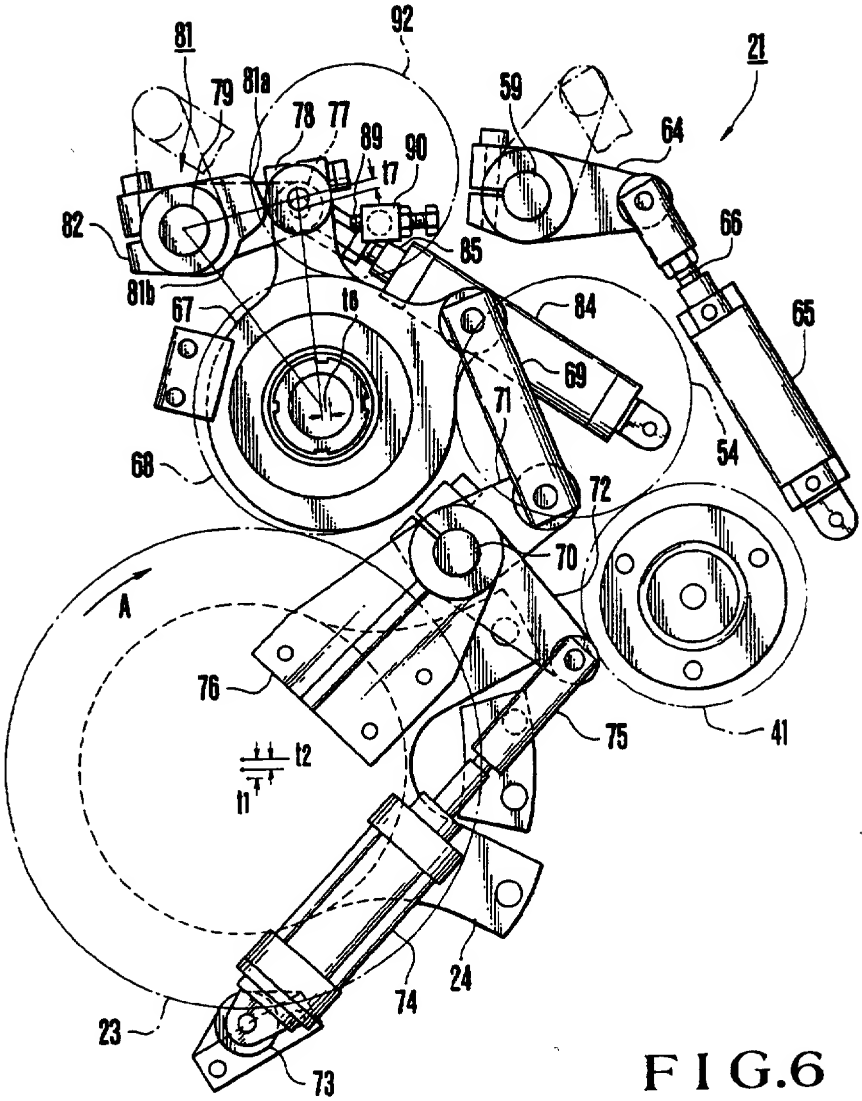


FIG. 5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92
21
79
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77
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90
t7
59
64
82
85
66
81b
67
t6
84
65
69
71
54
68
72
70
A
76
75
41
t2
t1
24
74
23
73

FIG.6

VARNISH COATER FOR PRINTED PRODUCT

BACKGROUND OF THE INVENTION

The present invention relates to a varnish coater disposed between a printing unit and a delivery apparatus of a rotary press or in an independent coating unit to apply varnish on a printed surface.

The surface of paper printed by a rotary printing press is not quickly dried and can be contaminated in the subsequent processing. In a sheet-fed rotary printing press, offsetting tends to be caused when printed sheets are stacked. In order to solve these problems, conventionally, a dryer is arranged in a delivery path of the printed products, or a powder is sprayed on the printed paper surfaces. However, in this case, the dryer becomes large, and powder spraying results in surface roughening of the printed surface. Surface roughening tends to entail a loss of gloss and subsequent poor printing. Instead of these techniques, varnish is applied to the printed surface to prevent the surface from being contaminated and to give it gloss. Varnishing is performed in printed products such as covers of books, catalogs and pamphlets which require an aesthetic effect.

The varnish coater is used as an independent apparatus. However, recently, the varnish coater is generally disposed in a delivery path of a printing press to shorten a coating time and an associated operation time for restacking the printed sheets and hence to improve the coating efficiency. The varnish coater generally has rollers in the same manner as that of a dampening apparatus for dampening a surface of a plate mounted on a plate cylinder of the printing unit. Varnish stored in a varnish pan is supplied to a surface of a blanket cylinder through the rollers. The varnish is transferred to a sheet passing between the blanket cylinder and an impression cylinder.

However, the conventional varnish coater of this thick paper such as a cover. The blanket on the surface of the blanket cylinder is partially deformed to result in a nonuniform thickness of the varnish film. In this case, a thickness of an underlay inserted between the blanket and the metal surface of the blanket cylinder must be adjusted after the rotary printing press is stopped. When the rollers are stopped for a long period of time while the coating operation is interrupted, varnish is hardened and many wasted paper sheets are produced when the coating operation is restarted. In order to prevent this, the rollers inserted between the form roller and the varnish type has the following problem in contact pressure adjustment between the blanket cylinder and the form roller for transferring varnish to the blanket cylinder. During the coating operation, since the blanket cylinder is in sliding contact with the form roller which transfers varnish to the blanket cylinder, the contact pressure of the form roller with respect to the blanket cylinder must be properly adjusted to obtain a uniform thickness of the varnish film to be coated on the printed sheet. On the other hand, the coating operation is often performed for pan must be brought into sliding contact with the form roller. After the blanket cylinder is washed or cleaned, the underlay is adjusted. Subsequently, after the underlay is adjusted, the blanket cylinder is located in the throw-on position. In this case, in order to properly perform the coating operation, the form roller must be brought into tight contact with the blanket cylinder to transfer varnish from the form roller to the blanket cylinder before the blanket cylinder is located in the throw-on position. The adjusting condition is preferably checked. For this purpose, the contact pressure of the form roller with respect to the blanket cylinder must be properly adjusted even if the blanket cylinder is located in the throw-off position.

In this manner, the contact pressure of the form roller with respect to the blanket cylinder must be controlled for both the throw-on and throw-off positions of the blanket cylinder. Conventionally, the contact pressure is adjusted by a turnbuckle and an eccentric pin, or by stoppers for defining the pivotal range of the form roller support arm. In addition, the contact pressure adjustments are independently performed at the throw-on and throw-off times of the blanket cylinder. The contact pressure adjustment must be performed every time irregular thickness is eliminated or the blanket of the blanket cylinder is worn out, resulting in time-consuming operation. In addition to this disadvantage, since an impact occurs when the form roller is brought into tight contact with the blanket cylinder by means of the form roller arm, the durability of the component parts is degraded upon repetition of the above contact operation. Furthermore, when the contact pressure is adjusted at the throw-on and -off positions, the pressure adjusted at one of the positions influences that at the other, resulting in inconvenience.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a varnish coater capable of simplifying adjustment of a contact pressure of a form roller with respect to a blanket cylinder at the throw-on and -off positions of the blanket cylinder.

It is another object of the present invention to provide a varnish coater capable of smoothly contacting the form roller with the blanket cylinder and improving the durability of the coater.

In order to achieve the above and other objects, the blanket cylinder and the form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/off the form roller with respect to the blanket cylinder, and rollers provided in the eccentric bearings of the form roller are brought by biasing means into tight contact with cam surfaces of cams pivoted by pivot means.

According to the present invention, there is provided a varnish coater for coating varnish transferred from a form roller to a blanket cylinder on a printed sheet passing through the blanket cylinder and an impression cylinder, comprising:

first eccentric bearings for supporting the form roller;

rolling members mounted on outer end portions of the first eccentric bearings, respectively;

cams which are pivotally supported by second eccentric bearings, respectively, and each of which has a large diameter portion and a small diameter portion which are selectively brought into contact with a corresponding one of the rolling members;

first pivoting means for pivoting the cams;

biasing means for biasing the rolling members each of which is brought into tight contact with one of the large and small diameter portions of a corresponding one of the cams; and

second pivoting means for pivoting the second eccentric bearings to shift an axis of a cam shaft of the cams.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a four-color sheet-fed offset rotary printing press;

FIG. 2 is a schematic side view of a fourth color printing unit and a coating unit of the rotary printing press shown in FIG. 1;

FIG. 3 is a side view of a varnish coater of the coating unit shown in FIG. 2 according to an embodiment of the present invention;

FIG. 4 is a developed sectional view of a portion including a blanket cylinder and a form roller of the varnish coater shown in FIG. 3;

FIG. 5 is a developed sectional view of a portion including a pan roller and a metering roller of the varnish coater shown in FIG. 3; and

FIG. 6 is a side view of a throw-on and -off mechanism for rollers in correspondence with the portion shown in FIG. 3 when viewed from the outside of the frame.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a four-color sheet-fed offset rotary printing press 1 comprises a sheet feeder 2, four color printing units 3, a coating unit 4 and a delivery apparatus 5. These components are separately assembled and constitute the rotary printing press 1. Each printing unit 3 has a plate cylinder 6 having a printing plate thereon, an inking apparatus (not shown) for supplying a corresponding ink to the cylinder surface, and a dampening apparatus 7 for supplying dampening water to dampen the cylinder surface. A blanket cylinder 8 is brought into contact with each plate cylinder 6 on which an image is formed by utilizing the corresponding color ink and water. The image on the plate cylinder 6 is transferred to the blanket cylinder 8 upon relative rotation therebetween. In each printing unit 3, an impression cylinder 9 having a diameter twice that of the blanket cylinder 8 is brought into contact therewith. A transfer cylinder 10 having the same diameter as the impression cylinder 9 is sandwiched between adjacent impression cylinders 9 of the corresponding printing units 3. An impression cylinder 11 having a diameter twice that of a blanket cylinder 23 (having the same construction as the blanket cylinder 8) of the coating unit 4 is disposed to be in contact with the blanket cylinder 23 and at the same level as the other impression cylinders 9 of the printing units 3. A transfer cylinder 12 is sandwiched between the impression cylinder 9 of the fourth color printing unit 3 and the impression cylinder 11 of the coating unit 4. Paper sheets 13 stacked on the feed table of the sheet feeder 2 are taken up by a sheet pick-up device (not shown) and are fed one by one onto a feedboard 14. Each sheet 13 is gripped with grippers of the first color impression cylinder 9 by means of a swing gripper. The sheet 13 is printed by the blanket cylinders 8 with four colors while the sheet 13 is sequentially fed by the transfer cylinders 10 and the corresponding impression cylinders 9. The printed sheet is then gripped by grippers of the impression cylinder 11 and is wound therearound.

The delivery apparatus 5 comprises a delivery cylinder 15 which is brought into contact with the impression cylinder 11, and a pair of right and left sprockets 16 which are coaxially mounted on the delivery cylinder 15. Delivery chains 19 each having grippers at equal intervals are respectively looped between the right and left sprockets 16 and front end sprockets 18 of a delivery frame 17. The sheet 13 gripped by the grippers of the impression cylinder 11 is gripped by the grippers of the chains 19 and transferred thereby. The sheet 13 is released from the grippers of the chains onto a stack board 20.

The coating unit 4 having the construction described above has a varnish coater 21 to be described below.

Referring mainly to FIG. 4, the blanket cylinder 23 having the same diameter as that of the blanket cylinder 8 is rotatably supported by right and left frames 22, respectively, through pairs of antifriction bearings 24 and plain bearings 25. The blanket cylinder 23 is rotated in the direction indicated by arrow A (FIG. 3) upon rotation of a cylinder gear 26 coupled to a driving source. The axes of the bearings 24 and 25 are respectively deviated by distances t1 and t2 with respect to the axis of the blanket cylinder 23. A lever 27 pivotally mounted on the corresponding rolling bearing 24 of the frame 22 is reciprocated by means of an air cylinder to bring the blanket cylinder 23 into contact with or separate it from the impression cylinder 11. A lever 28 pivotally mounted on the plain bearing 25 is reciprocated by a handle to adjust the contact pressure between the blanket cylinder 23 and the impression cylinder 11.

Referring mainly to FIG. 5, a DC variable motor 30 is supported and mounted on a bracket 29 fixed on the outer surface of one of the frames 22. A gear box 32 coupled to the shaft of the motor 30 through a coupling 31 is supported and mounted on a bracket 33 fixed on the outer surface of this frame 22. A driving gear shaft 34 is coupled to the motor shaft through a bevel gear which is disposed in the gear box 32 to be perpendicular to the motor shaft. A driving gear 36 supported by a stud 35 which extends outward from the frame 22 is fixed on the driving gear shaft 34. A gear shaft 38 is supported on the frame 22 through a bearing 39 to rotatably support an intermediate gear 37 meshing with the driving gear 36. One end of a pan roller 41 is rotatably supported by the bearing portion of the gear shaft 38 extending inwardly of the frame 22. The other end of the pan roller 41 is supported by a bearing 40 of the opposing frame 22. The pan roller 41 is dipped in varnish 43 stored in a varnish pan 42. A pan roller gear 44 is fixed on a collar in the vicinity of the gear shaft 38. Reference numerals 45 and 46 denote gears which respectively mesh with the intermediate gear 37 and the pan roller gear 44 to transmit a rotational force of the intermediate gear 37 to the pan roller 41. The gears 45 and 46 are mounted on a gear shaft 48 supported by a bearing 47 which is mounted on the frame 22. The pan roller 41 rotates in a direction indicated by arrow B (FIG. 3). L-shaped roller arms 49 and 50 (the shape of the roller arm 49 is illustrated in FIG. 3 in detail) are movably mounted between the collar of the pan roller 41 and the bearing 40 and between the collar of the gear shaft 38 and the bearing 39 through thrust bearings, respectively. Inverted T-shaped arms 51 (the shape thereof is illustrated in FIG. 3 in detail) are pivotally mounted through pins 52 on corresponding free ends of the L-shaped roller arms 49 and 50, respectively. A bearing 53 is pivotally mounted on the free end of each of the T-shaped arms 51 such that the axis of the bearing 53 is deviated by a distance t3 (FIGS. 3 and 5) with respect to the shaft of a metering roller 54 having an elastic surface. Therefore, the roller 54 is supported by the bearings 53 and is brought in contact with the pan roller 41. A gear 55 mounted on the end portion of the

shaft of the roller 54 is meshed with the pan roller gear 44, so that the roller 54 is rotated in the direction indicated by arrow C (FIG. 3). Bolts are loosened to pivot the bearings 53 so as to adjust a nip pressure acting on the pan roller 41.

One of the roller arms 49 is coupled to the corresponding T-shaped arm 51 through a lever 56 having an eccentric portion indicated by a distance t4 (FIGS. 3 and 5). A pin 57 of the eccentric portion is manually pivoted to throw on/off the metering roller 54 with respect to the pan roller 41. Reference numeral 58 denotes cams each having a large diameter portion 58*a* (FIG. 3) and a small diameter portion 58*b* (FIG. 3). The cams 58 are mounted on end portions of a cam shaft 59 mounted across the right and left frames 22. These end portions are adjacent to the inner surface portions of the right and left frames 22, respectively. Rollers 60 eccentrically (indicated by a distance t5) mounted on the free ends of the T-shaped arms 51 are in contact with the cam surfaces of the cams 58, respectively. Pivotal spring shafts 62 are mounted on studs 61 extending inward from the frames 22. One end of each of pivotal spring shafts 62 is pivotally mounted on the corresponding T-shaped arm 51. The T-shaped arms 51 urge the rollers 60 which tend to abut against the cams 58 by means of compression coil springs 63 mounted on the spring shafts 62, respectively. A piston rod 66 of an air cylinder 65 having an end mounted on the corresponding frame is pivotally coupled to the free end portion of a lever 64 fixed on the end of the cam shaft 59. When the piston rod 66 is moved to pivot the cams 58, the metering roller 54 can be brought into contact with or separated from the pan roller 41 through the rollers 60 and the T-shaped arms 51.

Referring again to FIGS. 3 and 4, eccentric bearings 67 (indicated by a distance t6 in FIG. 3) are respectively mounted on the frames 22 above the blanket cylinder 23. A form roller 68 is supported by the eccentric bearings 67 and is brought into contact with the blanket cylinder 23. As shown in FIG. 4, one end of a connecting lever 69 is coupled to an outwardly extended portion of one of the eccentric bearings 67, and the other end thereof is coupled to a lever 71 which is mounted on a lever shaft 70 mounted on the frame 22. An actuator end of a piston rod 75 of an air cylinder 74 pivotally coupled to the stud 73 extending outwardly from the frame 22 is coupled to a lever 72 fixed on the other end of the lever shaft 70. When the piston rod 75 of the air cylinder 74 is moved to pivot the eccentric bearings 67 through the coupling lever 69 and the like, the form roller 68 can be thrown on/off with respect to the blanket cylinder 23. Referring to FIG. 6, reference numeral 76 denotes a bearing fixed on the bracket at the side of the frame 22 to support the lever shaft 70 outside the frame 22. As shown in FIG. 4, the roller shafts 77 are split-clamped to be pivoted. Inner rings of rollers 78 each comprising a ball bearing are respectively fixed at the eccentric portions deviated by distances t7 with respect to the axis of the roller shaft 77. Reference numeral 79 denotes a cam shaft supported by the right and left frames 22 respectively through eccentric bearings 80. As shown in FIG. 6, the position of the cam shaft 79 is preset such that the axes of the cam shaft 79, the roller 78 and the form roller 68 correspond to apexes of a right angled triangle. Cams 81 each having a large diameter portion 81*a* and a small diameter portion 81*b* are split-clamped on the cam shaft 79. In other words, the cams 81 are respectively pivotal about the eccentric bearings 80 through the cam shaft 79. A lever 82 is split-clamped on the projecting end of the cam shaft 79, and the actuator end of a piston rod 85 of an air cylinder 84 pivotally supported by the frame 22 through a stud 83 is pivotally coupled to the free end portion of the lever 82. Bolts 86 respectively extend from the extended portions of the eccentric bearings 80 which extend inside the frames 22. The bolts 86 respectively engage with nuts such that these bolts 86 are inserted in handles 88 supported by studs 87 so as not to move axially. When the handles 88 are turned to move the bolts 86 so as to turn the eccentric bearings 80, respectively, the cams 81 are eccentrically moved together with the cam shaft 79 to shift its axis. In this throw-on and -off mechanism of the form roller 68, when the piston rod 75 (FIG. 5) of the air cylinder 74 is shortened (i.e., when the eccentric bearings 67 are pivoted clockwise in FIG. 6), the form roller 68 is separated from the blanket cylinder 23. In this case, the eccentric direction of the bearings 67 is preset such that the form roller 68 is separated from the blanket cylinder 23 while the distance between the form roller 68 and the metering roller 54 is kept to be substantially constant. In the state shown in FIG. 6, the blanket cylinder 23 is in contact with the form roller 68. In this case, the piston rod of the air cylinder 84 is shortened, and the large diameter portion 81*a* of each cam 81 is in contact with the corresponding roller 78. The roller 78 is biased by an air pressure of the air cylinder 74 to abut against the corresponding cam 81. Furthermore, when the blanket cylinder 23 is removed and the form roller 68 is thrown on the blanket cylinder 23, the piston rod 85 of the air cylinder 84 is elongated to pivot the cams 81 counterclockwise. As a result, the rollers 78 are respectively brought into contact with the small diameter portions 81*b* of the cams 81 by means of the biasing force of the air cylinder 74. Therefore, the form roller 68 is held in a state wherein it contacts the blanket cylinder 23. In other words, in the throw-on and -off positions of the blanket cylinder 23, the contact forces of the form roller 68 with respect to the blanket cylinder 23 are limited by the large diameter portions 81*a* and the small diameter portions 81*b* of the cams 81. Adjustment of these contact forces is effected by the movement of the cam 81 caused by the turning of the handle 88. Referring to FIG. 4, reference numeral 89 denote off-position stoppers which are screwed in studs 90 on the frames 22, respectively. When the blanket cylinder 23 is located in the throw-on position, the piston rod 75 of the air cylinder 74 is shortened, and the eccentric bearings 67 are respectively pivoted until they abut against the stoppers 89. Therefore, the throw-off position of the form roller 68 can be defined with respect to the throw-on position of the blanket cylinder 23. Referring to FIG. 4, reference numeral 91 denotes stoppers for defining the eccentric pivotal movement of the cams 81 when the lever 82 respectively abuts against the stoppers 91. As shown in FIG. 3, a rider roller 92 is supported at each end thereof by an arm 94 pivotal about a pin 93 on the side of the frame 22 and is brought in tight contact with the form roller 68. The arm 94 swings upon pivotal movement of a cam 95 by means of a handle (not shown), so that the rider roller 92 can be thrown on/off with respect to the form roller 68.

A drive mechanism of the motor 30, the cylinder gear 26 and the form roller 68 will be described.

One end of a clutch shaft 98 is supported by a bearing 96 fixed on the frame 22 in the vicinity of the motor 30, and the other end thereof is supported by a bracket 97

extending from the frame 22. A gear 99 is fixed on the clutch shaft 98 and is meshed with the driving gear 36 to transmit rotation of the motor 30 to the clutch shaft 98. A clutch gear 101 fixed on a one-way clutch 100 (to be described in detail later) on the clutch shaft 98 is meshed with a form roller gear 102 fixed in the end portion of the roller shaft of the form roller 68. The one-way clutch 100 has a known structure capable of transmitting a rotational force in only one direction. In this embodiment, the form roller 68 is a driven member, so that the rotational force of the motor 30 is transmitted only to the form roller 68. A one-way clutch 103 having the same construction as the one-way clutch 100 is arranged in an end portion of a roller shaft of the form roller 68. A clutch gear 104 coupled to the one-way clutch 103 is meshed with the cylinder gear 26 of the blanket cylinder 23. In this case, the form roller 68 is the driven member for the one-way clutch 103, so that the rotational force of the blanket cylinder 23 is transmitted only to the form roller 68. In this manner, the form roller 68 is selectively driven by the motor 30 and the blanket cylinder 23 through the one-way clutches 100 and 103; the form roller 68 does not simultaneously receive the rotational forces through the one-way clutches 100 and 103. Either of the one-way clutches 100 and 103 which transmits a higher rotational speed is coupled to the form roller 68, and the other one of the one-way clutches 100 and 103 which transmits a lower rotational speed is decoupled from the form roller 68.

The operation of the varnish coater 21 having the arrangement described above will now be described. The motor 30 of the varnish coater 21 is started to perform the coating operation while the blanket cylinder is located at the throw-off position. The cams 58 are pivoted by the air cylinder 65 to abut the rollers 60 against the small diameter portions 58*b* of the cams 58, respectively, so that the metering roller 54 is brought into tight contact with the pan roller 41 and the form roller 68 by means of the biasing forces of the compression coil springs 63. In this case, the piston rod 75 of the air cylinder 74 is elongated so that the rollers 78 of the eccentric bearings 67 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81. The form roller 68 is located in the throw-on position. However, since the blanket cylinder 23 is located in the throw-off position, the form roller 68 is separated from the blanket cylinder 23. In this case, the rotation of the motor 30 is transmitted to the pan roller 41 and the metering roller 54 through the bevel gear in the gear box 32, and the gears 36, 37, 45, 46, 44 and 55. The rotation of the motor 30 is also transmitted to the form roller 68 through the gears 36 and 99, the one-way clutch 100 and the gears 101 and 102. The blanket cylinder 23 is separated from the impression cylinder 11, and these cylinders are stopped. Upon rotation of the above-mentioned rollers, the varnish 43 is drawn by the pan roller 41 from the varnish pan 42. A thickness of the varnish film is adjusted upon contact between the pan roller 41 and the metering roller 54. The varnish film having a predetermined thickness is transferred to the form roller 68. Varnish circulates through the pan roller 41, the metering roller 54 and the form roller 68. When the rotary printing press is started to feed a sheet 13 onto the feedboard 14 by means of the automatic feeder 2, the blanket cylinders 8 of the printing units 3 are located in the throw-on positions, so that the sheet 13 is subjected to four-color process printing through the blanket cylinders and the corresponding impression cylinders 9. The printed sheet is fed toward the coating unit 4. When the printed sheet reaches the coating unit 4, the plain bearings 25 are pivoted in response to the command from a timing controller, so that the blanket cylinder 23 is located in the throw-on position, and that the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. Varnish circulating between the form roller 68 and the pan roller 41 is transferred to the blanket cylinder 23 and is applied to the printed sheet passing between the blanket cylinder 23 and the impression cylinder 11. The coated sheet 13 is fed by the delivery chains 19 and is stacked on the stack board 20. In the throw-on position of the blanket cylinder 23, the rotational force is transmitted from the motor 30 to the form roller 68 through the one-way clutch 100. At the same time, since the blanket cylinder 23 is located in the throw-on position, the rotational force of the blanket cylinder 23 is transmitted to the form roller 68 through the gears 26 and 104 and the one-way clutch 103. The rotational speed of the blanket cylinder 23 is higher than that of the motor 30, so that only the rotational force of the blanket cylinder 23 is transmitted to the form roller 68. The one-way clutch 100 is decoupled from the form roller 68.

The throw-on/off operation of the form roller 68 and the adjustment of the contact pressure of the form roller 68 with respect to the blanket cylinder 23 during the coating operation will be described.

During the coating operation as previously described, the blanket cylinder 23 is located in the throw-on position with respect to the impression cylinder 11 and the form roller 68. In other words, the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. In this case, the rollers 78 are respectively in contact with the large diameter portions 81*a* of the cams 81. The piston rod 75 of the air cylinder 74 is biased in a direction toward which the piston rod 75 is elongated by the air pressure. The rollers 78 are in tight contact with the large diameter portions 81*a* of the cams 81, so that the pivotal movement of the eccentric bearings 67 are defined by the tight contact between the rollers 78 and the corresponding large diameter portions 81*a*. As previously described, when the blanket of the blanket cylinder 23 is partially deformed and the thickness of the varnish film becomes nonuniform, the rotary printing press is stopped to eliminate irregular thickness of the underlay. In this case, the blanket cylinders 8 of the printing units 3 are located in the throw-off positions. At the same time, the blanket cylinder 23 of the varnish coater 21 is also located in the throw-off position with respect to the impression cylinder 11 and the form roller 68. Even if the blanket cylinder 23 is located in the throw-off position, the gear 26 continues to mesh with the the gear 104. The form roller 68 continues to be driven by the blanket cylinder 23 through the one-way clutch 103. At the same time, the pan roller 41 and the metering roller 54 continues to be driven by the motor 30, so that the varnish circulates between the varnish pan 42 and the form roller 68 and will not be hardened. The rollers 78 are held in contact with the large diameter portions 81*a* of the cams 81, respectively, so that the form roller 68 is separated from the blanket cylinder 23. After the blanket cylinder 23 is cleaned, the underlay of the blanket is adjusted to eliminate the nonuniform thickness of the underlay. After the adjustment is completed, the air cylinder 84 is actuated to elongate the piston rod 85. When the cams 81 are pivoted counterclockwise (FIG.

6) through about 90°, the rollers 78 are pivoted until they are respectively brought into tight contact with the small diameter portions 81*b* of the cams 81 since the eccentric bearings 67 are biased by the air cylinder 74. Therefore, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the throw-off position, so that the varnish in circulation is transferred from the form roller 68 to the blanket cylinder 23. In this condition, the operator can visually observe and check varnish coating from the form roller 68 to the blanket cylinder 23, thereby checking the result of underlay adjustment. When the printing operation is then restarted, the air cylinders 74 and 84 are actuated in response to predetermined time signals from the timing controller. The rollers 78 are brought into tight contact with the large diameter portions 81*a* of the cams 81 and the blanket cylinder 23 is located in the throw-on position. Therefore, the form roller 68 is brought into tight contact with the blanket cylinder 23 at a contact pressure preset by the cams 81 and the rollers 78.

In the coating operation performed in the manner as described above, when the blanket cylinder 23 is located in the throw-on position, the rollers 78 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81 by the air pressure of the air cylinder 74. The contact pressure of the form roller 68 with respect to the blanket cylinder 23 is defined by the tight contact between the rollers 78 and the corresponding large diameter portions 81*a*. On the other hand, when the blanket cylinder 23 is located in the throw-off position, the rollers 78 are respectively brought into tight contact with the small diameter portions 81*b* by the air pressure of the air cylinder 74. In this manner the contact pressure of the form roller 68 with respect to the blanket cylinder 23 is defined by the tight contact between the rollers 78 and the small diameter portions 81*b*. The contact pressure can be adjusted by rotating the eccentric bearings 80 mounted on the cam shaft 79 by means of handles 88. In other words, the contact pressure can be adjusted by a change in distance between the axes of the cam 81 and the corresponding roller 78. In this case, even if the position of the cam 81 is changed, the position of the large diameter portion 81*a* is not changed relative to that of the small diameter portion 81*b*. Only by changing the position of the cams 81, the contact pressures at the times when the blanket cylinder 23 is located in the throw-on and -off positions can be simultaneously adjusted. When split-clamping is released to pivot the roller shafts 77 of the rollers 78, the rollers 78 can be moved away from or closer to the axis of the roller 68. As is apparent from FIG. 6, the eccentric bearings 67 are slightly rotated, so that the difference (i.e., cam lift) between each small diameter portion 81*b* and the corresponding large diameter portion 81*b* can change. Therefore, the contact pressure at the time of throw-on operation of the blanket cylinder 23 relative to that at the time of throw-off operation thereof can be adjusted. In this case, if at least one of the large diameter portion 81*a* and the small diameter portion 81*b* comprises a concentric arc but has a slope along the circumferential direction, the cam lift can be easily changed. The zero contact pressure point adjustment can be easily performed. An error in the manufacturing process can be properly absorbed, and an adjustment at the time of wear can be easily performed.

In the above embodiment, the rollers 78 are respectively brought into tight contact with the surfaces of the cams 81 by the air cylinder 74 as the biasing means. If the form roller 68 need not be located in the throw-off position with respect to the blanket cylinder 23 when the blanket cylinder 23 is located in the throw-off position, the biasing means may comprise a coil spring in place of the air cylinder.

As is apparent from the above description, in the varnish coater for the printed product according to the present invention, the blanket cylinder and the form roller are respectively supported by eccentric bearings to throw on/off the blanket cylinder with respect to the form roller and an impression cylinder and throw on/-off the form roller with respect to the blanket cylinder, and the rollers provided in the eccentric bearings of the form roller are respectively brought by biasing means into tight contact with cam surfaces of cams pivoted by pivot means so as to change with an identical magnitude contact pressures of the form roller with respect to the blanket cylinder at the throw-on and -off positions of the blanket cylinder. By changing the position of the axis of the cam, the contact pressures of the form roller with respect to the throw-on and -off positions of the blanket cylinder can be simultaneously adjusted. Therefore operability can be greatly improved as compared with the conventional mechanism wherein the contact pressures are adjusted by the turnbuckle and the like, thereby improving the operation efficiency and decreasing labor. In addition to these advantage, since the form roller is brought into tight contact with or is separated from the blanket cylinder upon pivotal movement of the eccentric bearings, the impact caused by the contact between the form roller and the blanket cylinder is decreased, and durability of the members can be improved. In addition, the contact pressure adjustment at the time of throw-on position of the blanket cylinder will not influence that at the time of throw-off position thereof. Furthermore, the rollers can be adjusted to be away from and closer to the form roller. When the slope is formed on the cam surface along the circumferential direction of the cam, the cam lift can be changed. The error in the manufacturing process can be absorbed, and the cam lift adjustment at the time of wear of the cam surface can be easily performed.

What is claimed is:

1. A varnish coater for coating varnish transferred from a form roller to a blanket cylinder on a printed sheet passing through the blanket cylinder and an impression cylinder, comprising:

first eccentric bearings for supporting said form roller;

rolling members mounted on outer end portions of said first eccentric bearings, respectively;

cams which are pivotally supported by second eccentric bearings, respectively, and each of which has a large diameter portion and a small diameter portion which are selectively brought into contact with a corresponding one of said rolling members;

first pivoting means for pivoting said cams;

biasing means for biasing said rolling members each of which is brought into tight contact with one of said large and small diameter portions of a corresponding one of said cams; and

second pivoting means for pivoting said second eccentric bearings to shift an axis of a cam shaft of said cams.

2. A varnish coater according to claim 1, wherein said first pivoting means comprises:

an air cylinder which is operated in response to a given timing signal;

a piston rod which is reciprocally inserted in said air cylinder; and

a lever coupled between said piston rod and one of said cams to pivot said cams.

3. A varnish coater according to claim 1, wherein said biasing means comprises:

an air cylinder which is operated in response to a given timing signal;

a piston rod which is reciprocally inserted in said air cylinder;

a first lever one end of which is connected to said piston rod;

a second lever one end of which is connected to the other end of said first lever; and

a connecting lever one end of which is connected to the other end of said second lever and the other end of which is coupled to an extended portion of one of said first eccentric bearings.

4. A varnish coater according to claim 1, wherein said second pivoting means comprises:

bolts mounted on extended portions of said second eccentric bearings, respectively;

handles coupled to said bolts through studs, respectively; and

stoppers for defining a range of pivotal movement of each of said second eccentric bearings.

5. A varnish coater according to claim 1, wherein said cam shaft has an axis which constitutes a right-angled triangle together with axes of said rolling members and said form roller.

* * * * *

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United States Patent [19]
Ganho

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[54] **PROCESS AND COMPOSITIONS FOR LITHOGRAPHIC PRINTING IN MULTIPLE LAYERS**

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[58] **Field of Search** 106/290, 300, 307, 310, 106/316; 427/258; 428/499; 524/270–274, 284, 313, 441, 477–478, 764, 798; 527/600

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[57] **ABSTRACT**

Printed materials such as tickets, lottery forms, cards and contest forms, bearing a hidden message which is revealable by scratching off a covering opaque layer, are prepared by printing the message on the substrate, lithographing a protective layer such as a clear varnish or a pigmented varnish-ink over the hidden message, and then lithographing a hiding coat over the applied protective layer. The protective layer formulation and the hiding coat layer are both based upon compatible, preferably the same, film forming resin systems, and are deposited from a common solvent. The protective layer may provide a clear, colorless transparent film through which the message may be viewed, or a colored see-through layer, so that it constitutes one color layer also for the printing of other areas of the substrate.

4 Claims, No Drawings

PROCESS AND COMPOSITIONS FOR LITHOGRAPHIC PRINTING IN MULTIPLE LAYERS

FIELD OF THE INVENTION

This invention relates to printing methods and printing ink compositions. More particularly, it relates to methods and compositions for making sheets such as paper sheets or cards covered with superimposed layers of print, the lower of which comprises a "hidden" message which is masked from a reader unless and until an upper coating is removed, e.g. by abrasion, scratching and erasures.

BACKGROUND OF THE INVENTION

Recently, the preparation and distribution of promotional game cards, premium cards, lottery tickets and the like, containing hidden messages or symbols has become popular and widespread, in fund raising and product promotion. The recipient of such a card must remove from the card a layer of hiding coating in order to reveal a message or symbol. Such items are, however, difficult to prepare and print in an economical fashion, because of the technical specifications they must fulfill.

Such a card bearing a hidden message normally has at least two coating layers overlying a hidden message. Immediately over the message, a transparent or translucent protective layer is provided, through which the message can be read. Over the protective layer, an opaque second layer ("hiding layer") is applied in order to hide the message. The hiding layer can be subsequently stripped away e.g. by scratching etc., to reveal the message through the first coat.

It is necessary that there exists, as between the protective coat or layer and the hiding coat or layer an acceptable degree of adhesion or affinity, so that the hiding coat remains in place and opaque to hide the message during storage, shipping, packaging and transportation of the cards. Nevertheless, the hiding coat ("scratch-off coat") must be readily removable by abrasion by the user at the required time, to render the message visible, leaving the first coat susbtantially unaffected.

Effectively, one must satisfy two essentially contradictory requirements in the relationship between the varnish coat and the hiding coat, to render them mutually compatible and adhesive to one another at one time, and imcompatible and non-adhesive to one another at another time.

Heretofore, these mutually inconsistent requirements have been satisfied by using a thick hiding coat applied by silk screen methods, over a thin varnish coat applied by lithographic methods or by silk screen methods. In view of its thickness and consistency, the only practical way of applying the hiding coat is by silk screening. This is costly and inconvenient. Lithography is the cheapest, fastest way of printing and applying coatings to such cards. To have to apply one coating by lithography and the other coating by silk screening entails the transfer of the card stock from one printing machine to another, or even the transferring from one printing plant to another printing plant, with consequent added inconvenience, extra expense and loss of security.

SUMMARY OF THE INVENTION

The present invention provides an improved process for preparing printed or coated cards or similar items bearing hidden messages under a layer of protective coat and a layer of hiding coat superimposed thereon. In the process of the present invention, both the protective coat and the hiding coat may be applied to the card lithographically. To facilitate this, the protective coat formulation and the hiding coat formulation are deposited from compatible solvent sysytems and contain mutually compatible resin systems. Then the hiding coat, containing opacifying pigments, can be applied as a thin layer, suitably formulated to be applied by lithography, and still exhibit the necessary hiding power whilst being abrasively removable. In addition, if desired, further printing of patterns can be applied over the hiding coat.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The protective coat formulation and the hiding coat formulation have film-forming resin systems which are mutually compatible. Preferably they comprise generally the same resins or types of resins in both formulations. The protective coat formulation may comprise a pigment free varnish, so as to produce a light coloured translucent or transparent film when dried and cured in place to reveal the message below. Alternatively and preferably however, the protective coat is pigmented with a light coloured pigment so that it may constitute one of the printing colour formulations for application to other areas of the substrate, so as to save one application step in the process. As compared with varnish previously used for this purpose, the protective coat used in the present invention has a higher energy surface, less repellant to and compatible with the pigmented hiding coat. The protective coat formulation contains curatives (hardeners) which will result in the formulation of a hard, cured film, but which is not so hard as to reject the application of the hiding coat. The hiding coat preferably contains the same or similar film forming resin system, but is cured to a lesser degree. The relative degree of cure between the two layers helps to adjust the degree of adhesion between them tending to fulfill the contradictory requirements mentioned above, and permits the scratch-off removal of the hiding coat.

Preferably, the hiding coat contains pigments or opacifying agents which render the finished coat not only visibly opaque but also opaque to all other forms and wavelenghts of radiation also so that the hidden message cannot be prematurely revealed e.g. by x-rays, UV light etc. For this purpose the hiding coat formulation should contain a powdered metal such as powdered aluminum, in addition to regular pigments such as carbon black, dyes etc.

Examples of suitable resins for use in both the protective coat (clear or pigmented varnish-ink formulation) and the hiding coat formulation are phenolic resins such as phenolic modified rosin esters, hydrocarbon resins, alkyd resins such as linseed-isophthalic alkyd and other unsaturated alkyds resins and the like, and mixtures thereof. Such resin systems are curable with heavy metal-organic salt such as manganese octoate and cobalt octoate, to yield the light coloured or transparent films. They can be plasticised if desired, e.g. with waxes of the hydrocarbon type. When a clear varnish is required, the varnish formulation should of course be free from pigments, but may contain other ingredients in minor proportions to modify its surface properties. For example, small amounts of Montan wax, Carnuaba wax or an-

other natural or synthetic wax of similar characteristics, can be added to give a harder surface finish. Such a wax component may in fact migrate to the surface of the coating after curing ("bloom") and then contribute to the surface characteristics of the cured varnish layer. When a pigmented varnish-ink is required, a conventional pigment compatible with the solvent and resin formulation is used therein. The hiding coat formulation should include a drying oil such as refined linseed oil, and smaller amounts of curative, along with opacifying agents, to yield a film of suitable hiding qualities and compatibility with the protective film, yet readily abrasively removable therefrom.

As noted, both the protective layer formulation and the hiding coat formulation should be deposited from compatible solvent sytems, preferably from the same solvent system. Hydrocarbon solvents (e.g. Magie oil, a mixture of aliphatic and aromatic oils) are preferred. The protected layer formulation will normally contain substantially larger proportions of solvent, and hence be of substantially thinner consistency, than the hiding coat formulation. Both formulations are nevertheless of a suitable consistency for application by lithography. The solvent used for the hiding coat should not be capable of penetrating the cured protective layer coat to any significant extent, despite the fact that the very same solvent may well have constituted the vehicle for deposition of the uncured protective layer. Accordingly, a fast drying system is chosen, which cures to a hard finish to prevent solvent and pigment penetration thereof from the hiding coat, but which nevertheless "traps" the subsequently applied hiding coat to the necessary degree.

In order to be satisfactory for lithographic application, an ink formulation must be adjusted in relation to the printing machine speed, to adjust its rate of drying and curing. On a high speed machine, the amount of heat generated by the machine may cure the protective layer formulation to such an extent the the applied layer will not transfer from the plate cylinder to the rubber blanket cylinder and on down the roller train. Accordingly, depending upon the speed and nature of the lithographic printing machine by means of which the protective layer is to be applied, it may be necessary to retard the drying or hardening of the rate of the protective layer as compared with the normal varnishes. This is most commonly encountered when using clear, non-pigmented varnishes in the present invention as the hiding coat. When a slower speed of machine is employed, such retardation may not be necessary.

The following is a preferred general formulation for a clear, non-pigmented varnish for use as the protective layer in the present invention particularly for use with fast running web litho printing machines, with the ingredients expressed as percentages by weight.

Components	% Range
Magie oil (solvent)	30–35
Phenolic modified rosin ester	16–20
Hydrocarbon resin (e.g. of the PICCOPALE* type)	13–17
Linseed-isophthalic alkyd	10–13
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	7–10
Montan wax	3–6
Calcium perborate	1.5–3
Manganese octoate	1.5–2
Cobalt octoate	0.5–1
Gelling agent	0.5–0.7

-continued

Components	% Range
Chinawood oil	0.3–0.5

*Trade mark

In this formulation, cobalt octoate, manganese octoate and calcium perborate constitute the curing system. The calcium perborate helps to cure the chinawood oil, by supplying oxygen thereto. Similar hydrocarbon flexibilizer may be used in place of DUTREX as the plasticizer. Also similar hydrocarbon rosins may be used in place of PICCOPALE. The chinawood oil (tung oil) is optionally added, to adjust the consistency and tackiness of the surface. The gelling agent also adjusts the consistency of the formulation. As gelling agent, there can be used any suitable product from the reaction of an unsaturated fatty acid, a solvent and calcium octoate. Alternatively, thickener such as fumed silica may be used as or instead of a gelling agent.

For clear varnish application using a slower, sheet fed machine, such a varnish might not result in a coating which would satisfactorily trap the hiding coat. The above formulation would accordingly be modified for example, by reducing or omitting one or more of the gelling agents, calcium perborate, chinawood oil, wax or hydrocarbon resin.

In the preferred process according to the present invention, the card or paper stock is initially printed, in a first colour, with the indica to be subsequently covered with the "scratch-off" hiding coat (the "hidden message") at the appropriate location, lithographically. At the same time and from the same plate, any other areas of the stock may be appropriately printed with the same colour, e.g. with text, picture, design, etc. Normally, the first colour will be the darkest colour to be applied, e.g. black or dark blue. The ink composition used for the first lithographic application step may be of the composition according to the invention, i.e. a varnish-ink, or a standard conventional lithographic ink suited to the base stock.

In the next step of the preferred process, the stock is overprinted lithographically with a second colour, of a varnish-ink according to the invention, at least in the area of the "hidden message", as a solid block covering it. This second colour may be applied wet-on-wet over the first colour. Preferably it is restricted to cover only the area of the "hidden message", but may if desired be used to apply additional text or colour to other areas of the stock. Red is a suitable choice for the second colour. The "hidden message" is still readable through the applied second coat.

There then follow optional steps of lithographic application of additional colour, to complete the printing of the stock. If it is required to produce full-colour printing on the stock, e.g. with full colour illustration, two more colours, e.g. green and yellow, are applied successively, wet-on-wet, over the second colour by lithographic means. Thus a standard four-colour lithographic printing machine can be used. If any of the subsequently applied colours are to cover the "hidden message", then the composition of such colour must be a varnish-ink according to the present invention. It is however preferred to avoid further coating of the "hidden message" with the subsequently applied colours, so that they can be formulated according to standard lithographic ink formulation, compatible with the stock and the previously applied coats. It is however to be empha-

sized that the third and fourth colour applications are optional and not essential to the successful practice of the process of the invention.

After the desired number of colour coats have been thus lithographically applied, the printed stock is allowed to dry, and then the scratch-off hiding coat is applied lithographically to the "hidden message" area. Drying of the colour coats normally takes from 6–24 hours, so that the hiding coat application is conveniently conducted the following day. The hiding coat, for formulation previously described, is lithographically applied over the "hidden message" area, in one, two or three wet-on-wet applications using a standard lithographic plate and printing machine. Then the hiding coat is dried. It is found that the hiding coat successfully adheres to the coating over the "hidden message" so as to render it undecipherable, and is sufficiently adhesive and durable to withstand normal handling and transportation of the printed stock. Nevertheless, it can be readily scratched off, to reveal the "hidden message" through the coating of the second colour.

The varnish-ink formulation is as previously described, merely including a suitable amount of a suitable pigment in addition to the previously mentioned ingredients.

With regard to the curing and the drying of the pigmented varnish-ink, it has additionally been found that the pigmented varnish-ink can be cured in a minimum amount of time. Curing and drying of a pigmented varnish under an infra-red energy source can be completed in as little as 30 minutes. This provides additional time savings for operations of this type.

In order to formulate the pigmented varnish of the present invention, 15–25% of the normal pigment (ink) vehicle usually employed in lithographic printing, is substituted by the varnish identified above. The varnish may be substituted in any colours of ink in order to formulate the pigmented varnish. In this way, a large number of colours may be used to print the message and any other pattern required on the card. A number of layers of differently coloured pigmented varnishes may be applied in sucession, in order to print a multicoloured pattern and/or message on the card. It is, of course, necessary that in such cases, the colour of the second layer and any additional layer be chosen so as to maintain visibility of the message printed by the first layer.

In formulating the pigmented varnish, the extent of the varnish substitution for normal ink vehicle is dependent on the colour sequence used in the printing process. It is most desirable that the uppermost layer of pigmented varnish contains a higher percentage of the varnish than the lower layers so as to provide optimum communication between the pigmented varnish and the hiding layer.

The following is a preferred general formulation for the pigmented varnish-ink for use in the present invention. The amounts of ingredients are expressed as parts by weight:

Components	% Range
Magie oil (paraffin based solvent)	20-28
Phenolic modified rosin ester	14-18
Hydrocarbon resin (e.g. of the PICCOPALE* type)	8-12
Linseed isophthalic alkyd	6-10
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	6-8
Isophorone diamine	0.5-1.5
Texanol isobutyrate	2-5

-continued

Components	% Range
Montan wax	2-5
Calcium perborate	1-3
Manganese octoate	1-2
Cobalt octoate	0.5-1
Gelling agent	0.3-0.6
Chinawood oil	0.3-0.5
Pigment	16-25

*Trade Marks

It should be noted that the pigmented varnish may also be prepared by mixing known inks of desired colour directly with the varnish. In this case, it will be evident that dilution of the pigment will result. Additional pigment may be added to retrieve the original intensity of the ink, if desired.

Preferably, the hiding coat contains pigments or opacifying agents which render the finished coat not only visibly opaque but also opaque to all other forms and wavelengths of radiation also, so that the "hidden message" cannot be prematurely revealed e.g. by x-rays, UV light etc. For this purpose the the hiding coat formulation should contain a powdered metal such as carbon black, dyes etc.

A suitable such hiding coat is as follows, with the amounts of ingredients expressed as percentages by weight:

Components	% Range
Titanium dioxide	28-35
Aluminum powder	15-20
Phenolic modified rosin ester	15-18
Linseed oil refined	9-11
Black pigment (carbon black)	7-8
Linseed-isophthalic alkyd	5-8
Magie solvent	5-7
Cobalt octoate	0.5-1
Chinawood oil	0.5-1
Hydrocarbon resin	0.5-1
Polyethylene wax	0.3-0.5
Fischer-Tropsch wax	0.2-0.5
Gelling agent	0.5-1

The hiding coat formulations for use in the present invention may be the same as described above or may contain an additional ingredient. It has been found that incorporation of one or more species of long chain fatty amides, of which may be mentioned erucamide, erucyl stearamide and erucyl erucamide, will improve the scratch-off properties of the hiding coat without impairing its integrity during the normal handling and storage. Incorporation of the long chain fatty amides with the above mentioned hiding coat formulation in a preferred range of about 10–20% by weight has been found to provide easier removal thereof by abrasion by the user and improved clarity of the uncovered message.

It will be noted that the above hiding coat formulation has the same basic resin system and solvent as the clear varnish or the pigmented varnish-ink formulation. It differs, however, in the amount of solvent and hence consistency, in the amount of curing system, and in the presence of opacifying agents of those mentioned in the specific formulations. Other suitable unsaturated oils may be used instead of linseed oil, and instead of chinawood oil. The gelling agent is as described in connection with the pigmented varnish-ink coat. The presence of some such unsaturated oil is highly advantageous in providing the best "scratch-off" properties. The lin-

seed-isophthalic alkyd resin in both the formulations is represented of a large variety of available such materials, and substantially any other unsaturated alkyd could be used instead. Isophthalics are preferred however.

The pigmented varnish-ink coat is suitably applied to a printed card stock by sheet fed or web lithograph methods. The aforementioned formulations are most suitable for sheet fed lithography. The consistency of the formulations needs adjustment to render them more suitable for web lithography.

The pigmented varnish-ink layers, suitably 2-4 in number, wherein each layer may be the same or a different colour, may be applied wet-on-wet, i.e. without waiting for the previously applied layer of pigmented varnish to dry and cure. The total pigmented varnish coat must however, as mentioned, be dried and cured before the hiding coat is applied. Then the hiding coat is also suitably applied to the stock, over the pigmented varnish, in one or several wet-on-wet layers, and then allowed to dry and cure.

The resulting hiding coat is durable not only to withstand normal storage and handling, but also to receive further overprintings and additional hiding layers, patterns or printed information, should this be required. The scratch-off portion can be readily removed by the user's fingernails, without abrasives, coins, files, erasers or the like, to show clearly the overprinted "hidden message".

The invention is further illustrated in the following specific examples.

EXAMPLE

The following specific pigmented varnish-ink formulation (a red ink) and hiding coat formulation were made up, with ingredients listed as weight percentages:

Red Varnish-Ink Formulation

Components	%
Magie oil (paraffin based solvent)	25
Phenolic modified rosin ester	15
Hydrocarbon resin (e.g. of the PICCOPALE* type)	14
Linseed isophthalic alkyd	8
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	6
Isophorone diamine	1
Texanol isobutyrate	4
Montan wax	3
Calcium perborate	2.2
Manganese octoate	0.3
Cobalt octoate	0.5
Gelling agent	0.5
Chinawood oil	0.5
Pigment (Permanent Carmine FBB02 (CI, 12485)	20

*Trade Marks

Hiding Coat Formulation

Components	%
Titanium dioxide (TIOXIDE*)	32
Aluminium powder	18
Phenolic modified rosin ester	16
Linseed oil refined	10
Black pignent (carbon black)	8
Linseed Isophthalic alkyd	5
Magie solvent	6
Cobalt octoate	0.6
Chinawood oil	0.6
hydrocarbon resin (PICCAPOLE* Type)	1
Polyethylene wax	0.3
Fischer-Tropsch wax	0.3

-continued

Hiding Coat Formulation

Components	%
Gelling agent	0.6

*Trade Marks

The red varnish-ink formulation was applied, by sheet fed lithographically using a standard printing machine, to a card stock bearing indicia previously printed with a standard black ink known for use in lithographic printing. The card contained an area with a printed message which was to be hidden. The carmine pigmented-ink formulation was applied lithographically over the message area such that the entire message was covered by a solid rectangular block of the red varnish-ink. The message was clearly visible and legible through the red varnish-ink coat. The applied red varnish-ink coat was allowed to dry and cure for one way.

Next, using the same sheet fed lithographic printing machine, the hiding coat was applied directly over the cured varnish-ink coat. Four layers were applied, wet on wet, and then the hiding coat was allowed to dry.

The hiding coat so formed completely obliterated the underlying message. It was durable enough to withstand normal handling and packaging. Nevertheless, it was removable by scratching with a fingernail, to reveal the varnish coat substantially unaffected, through which the printed message was clearly visible.

EXAMPLE 2

By replacing the carmine pigment component in the varnish-ink formulation of example 1, black pigmented, yellow pigmented, and blue pigmented varnish-ink were prepared. The carmine varnish-ink was also prepared as per example 1.

Using the black-pigmented varnish-ink, a first layer was printed on a black substrate by a sheet-fed lithographic press having four printing stations in serial arrangement. This first black layer marked characters on the blank substrate including the indicia which were to be hidden, i.e. the "message".

The indicia-bearing substrate was passed, while still "wet" to a second pressing station on the same lithographic press where the carmine pigmented varnish-ink was applied such that the entire area encompassing the message was covered or "masked" by the carmine ink-varnish. Other areas were printed on the substrate at this same, station and with the same carmine pigmented varnish-ink in this printing step in order to add colour to the characters on the card outside the area containing the message. The masking provides a surface over the message which enables the hiding layer to be reversibly trapped within the area of the masking. The message was clearly visible and legible through the carmine layer.

A third layer of yellow-pigmented varnish-ink was then applied at the next station on the same lithographic press to the substrate on areas outside of the message area. This additional layer served to add colour to the characters on the face of the card.

To provide an even more colourful card the substrate was passed from the yellow-pigmented printing station to the fourth and final printing station on the press where the blue-pigmented varnish-ink was appropriately layered on areas outside the message area.

Although it is within the scope of the invention to apply either or both of the yellow and blue-pigmented

varnishes into the masked area at the subsequent printing stations it will be realized that, since the carmine layer i.e. the first masking layer will fulfill the aforementioned requirements of releasably trapping the hiding layer, savings on ink consumed in the printing process can be obtained by omitting the application of more than one blocking layer.

After the final fourth layer was printed, the substrate was removed and allowed to cure until the next day. Means for reducing the curing time can be used to accelerate the curing process, if desired, such as an infra red energy source, etc.

The substrate with the cured varnish-ink layers was then introduced into a lithographic press having, again, four printing stations, each of which contained a hiding coat formulation as exemplified in example 1. The hiding coat was applied directly over the carmine pigmented area blocking the message at each successive station.

The layers were applied wet-on-wet. After passing through the press the card was removed and allowed to dry.

The following day, it was found that the hiding coat layer was completely removeable to reveal the hidden message by scratching with a fingernail.

EXAMPLE 3

The following specific varnish-formulation and the hiding coat formulation of example 1 were made up, with ingredients listed as weight percentages:

VARNISH

Components	%
Magie oil (solvent)	32
Phenolic modified rosin ester	18
Hydrocarbon resin (e.g of the PICCOPALE* type)	16
Linseed isophtholic alkyd	10
Hydrocarbon plasticizer (e.g. of the DUTREX* type)	8
Montan wax	3.5
Calcium perborate	2.2
Manganese octoate	
Cobalt octoate	0.7
Gelling agent	0.5
Chinawood oil	0.7

*Trade Mark

The varnish formulation was applied, by sheet fed lithography using a standard printing machine, to a card stock previously printed with a message to be hidden. Three layers of applied varnish were applied successively, wet-on-wet and then the applied varnish was allowed to dry and cure. A light coloured, transparent film was formed, through which the underlying printed message was clearly visible and legible.

Next, using the same sheet fed lithographic printing machine, the hiding coat was applied over the cured varnish coat. Four layers were applied, wet-on-wet, and then the hiding coat was allowed to dry.

The hiding coat so formed completely obliterated the underlying message. It was durable enough to withstand normal handling and packaging. Nevertheless, it was removable by scratching with a fingernail to reveal the varnish coat substantially unaffected, through which the printed message was clearly visible.

Whilst according to the invention, it is preferred to apply the varnish-ink coat and the hiding coat lithographically, it is nevertheless possible to apply the varnish-ink coat by letterpress application and the hiding coat lithographically, thus retaining the principle advantage, of avoiding silk screen application. In such case, the hydrocarbon resin component is omitted from the varnish-ink formulation.

I claim:

1. A varnish composition suitable for lithographic application to a substrate to cover indicia printed thereon preparatory to hiding said indicia with an abrasively removable hiding coat, said composition including the following ingredients in the following approximate weight range:

Components	% Range
Magie oil (solvent)	30–35
Phenolic modified rosin ester	16–20
Hydrocarbon resin	13–17
Linseed-[isophtholic] isophthalic alkyd	10–13
Hydrocarbon plasticizer	7–10
Montan wax	3–6
Calcium perborate	1.5–3
Maganese octoate	1.5–2
Cobalt octoate	0.5–1
Gelling agent	0.5–0.7
Chinawood oil	0.3–0.5

2. A pigmented varnish-ink composition suitable for lithographic application to a substrate to cover indicia printed thereon preparatory to hiding said indicia with an abrasively removable hiding coat, said composition including the following ingredients in the following approximate weight range:

Components	% Range
Magie oil (paraffin based solvent)	20–28
Phenolic modified rosin ester	14–18
Hydrocarbon resin	8–12
Linseed-isophthalic alkyd	6–10
Hydrocarbon plasticizer	6–8
Montan wax	2–5
Calcium perborate	1–3
Manganese octoate	1–2
Cobalt octoate	0.5–1
Gelling agent	0.3–0.5
Chinawood oil	0.3–0.5
Pigment	16–25

3. A hiding coat composition suitable for lithographic application over a cured varnish coating as claimed in claim 1, and including the following ingredients in the following approximate weight ranges:

Components	% Range
Titanium dioxide	28–35
Aluminum powder	15–20
Phenolic modified rosin ester	15–18
Linseed oil refined	9–11
Black pigment (carbon black)	7–8
Linseed-isophthalic alkyd	5–8
Magie solvent	5–7
Cobalt octoate	0.5–1
Chinawood oil	0.5–1
Hydrocarbon resin	0.5–1
Polyethylene wax	0.3–0.5
Fischer-Tropsch wax	0.2–0.5
Gelling agent	0.5–1

4. A hiding coat suitable for lithographic application over a cured pigmented varnish-ink composition according to claim 2, and including the following ingredients in the following approximate weight range:

Components	% Range
Titanium dioxide	28–35
Aluminum powder	15–20
Phenolic modified rosin ester	15–18
Linseed oil refined	9–11
Black pigment (carbon black)	7–8
Linseed-isophthalic alkyd	5–8

-continued

Components	% Range
Magie solvent	5–7
Cobalt octoate	0.5–1
Chinawood oil	0.5–1
Hydrocarbon resin	0.5–1
Polyethylene wax	0.3–0.5
Fischer-Tropsch wax	0.2–0.5
Gelling agent	0.5–1

* * * * *

United States Patent [19]

Ito et al.

[11] **Patent Number: 4,569,306**

[45] **Date of Patent: Feb. 11, 1986**

[54] **VARNISH COATER FOR PRINTED PRODUCT**

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[73] Assignee: **Komori Printing Machinery Co., Ltd.**, Tokyo, Japan

[21] Appl. No.: **576,220**

[22] Filed: **Feb. 2, 1984**

[30] **Foreign Application Priority Data**

Feb. 3, 1983 [JP] Japan 58-16600

[51] **Int. Cl.⁴** **B05C 1/02**

[52] **U.S. Cl.** **118/249**; 118/46; 118/236; 118/262

[58] **Field of Search** .... 118/46, 249, 203, 262, 118/236; 101/350, 351, 352, 416 B

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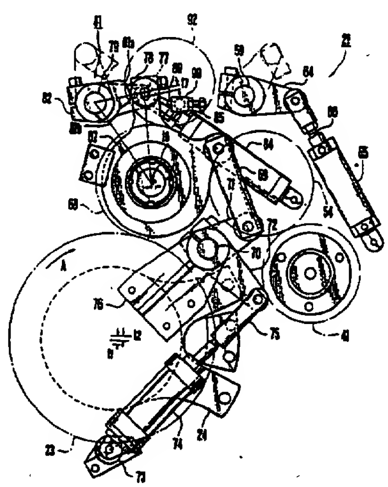
Primary Examiner—John P. McIntosh

Attorney, Agent, or Firm—Blakely Sokoloff Taylor & Zafman

[57] **ABSTRACT**

In a varnish coater, a set of a blanket cylinder and a form roller and a set of a pan roller and a metering roller are driven by different drive sources. One-way clutches are arranged between the blanket cylinder and the form roller and between the form roller and a motor as one of the different drive sources, respectively. The form roller is selectively driven by one of the different drive sources through a corresponding one-way clutch. Alternatively, the form roller is driven by one of the drive sources which has a higher rotational speed.

5 Claims, 8 Drawing Figures



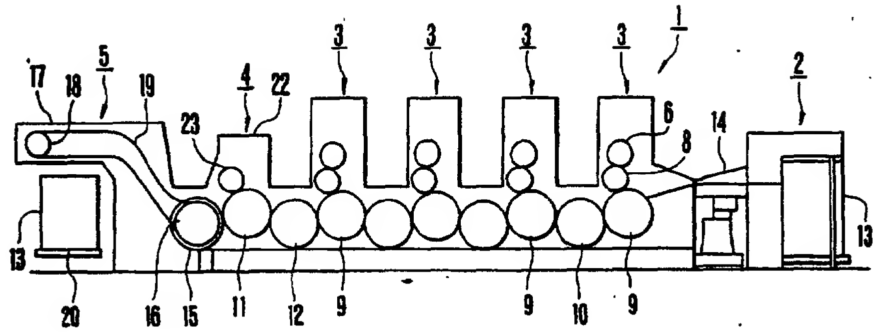

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FIG.1

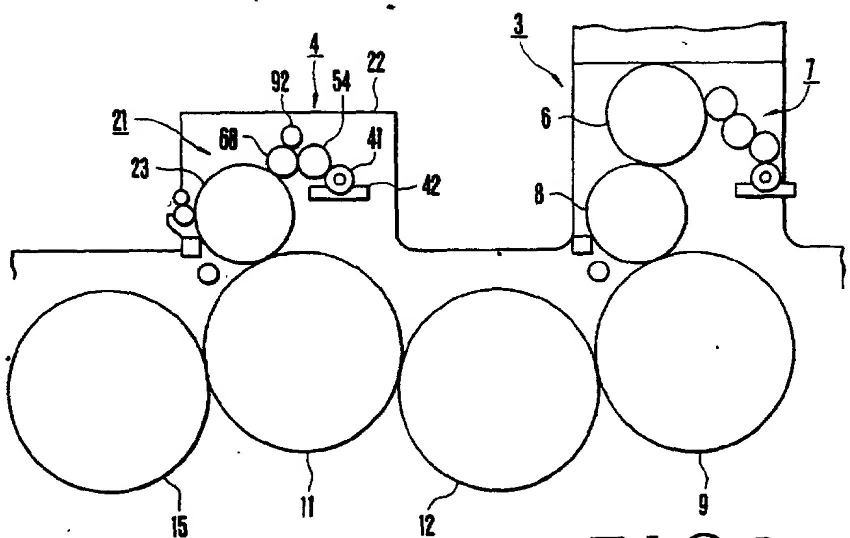
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FIG.2

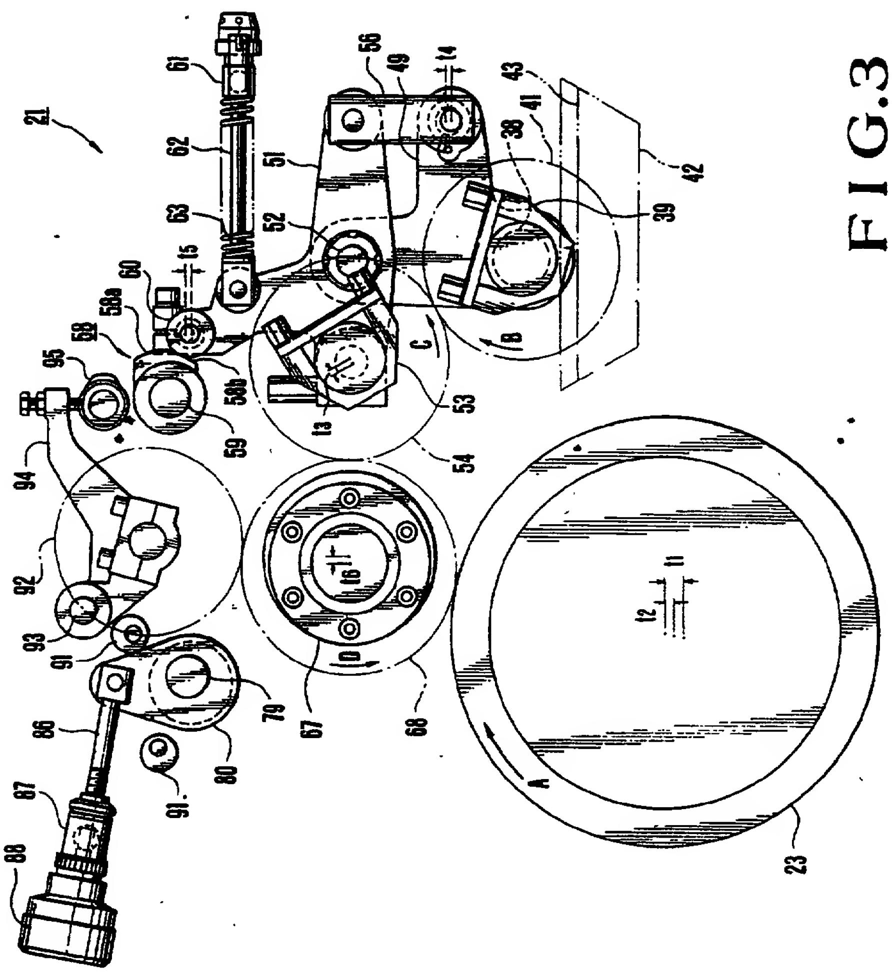


FIG.3

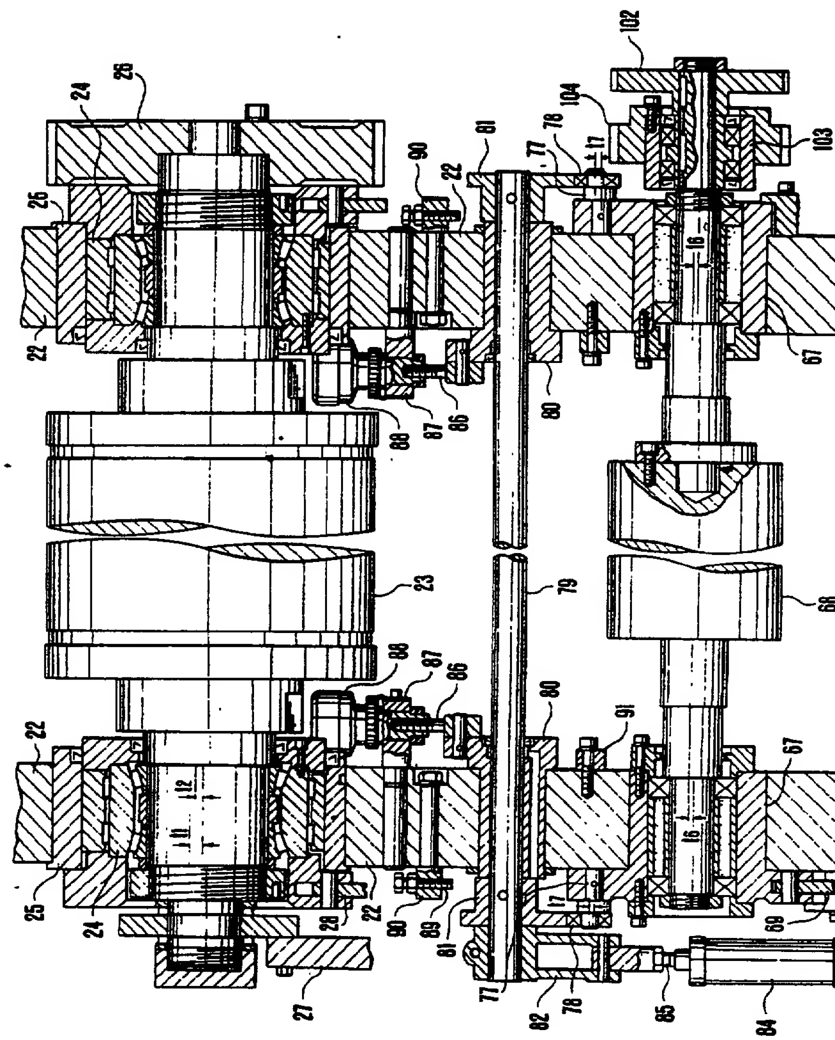


FIG. 4

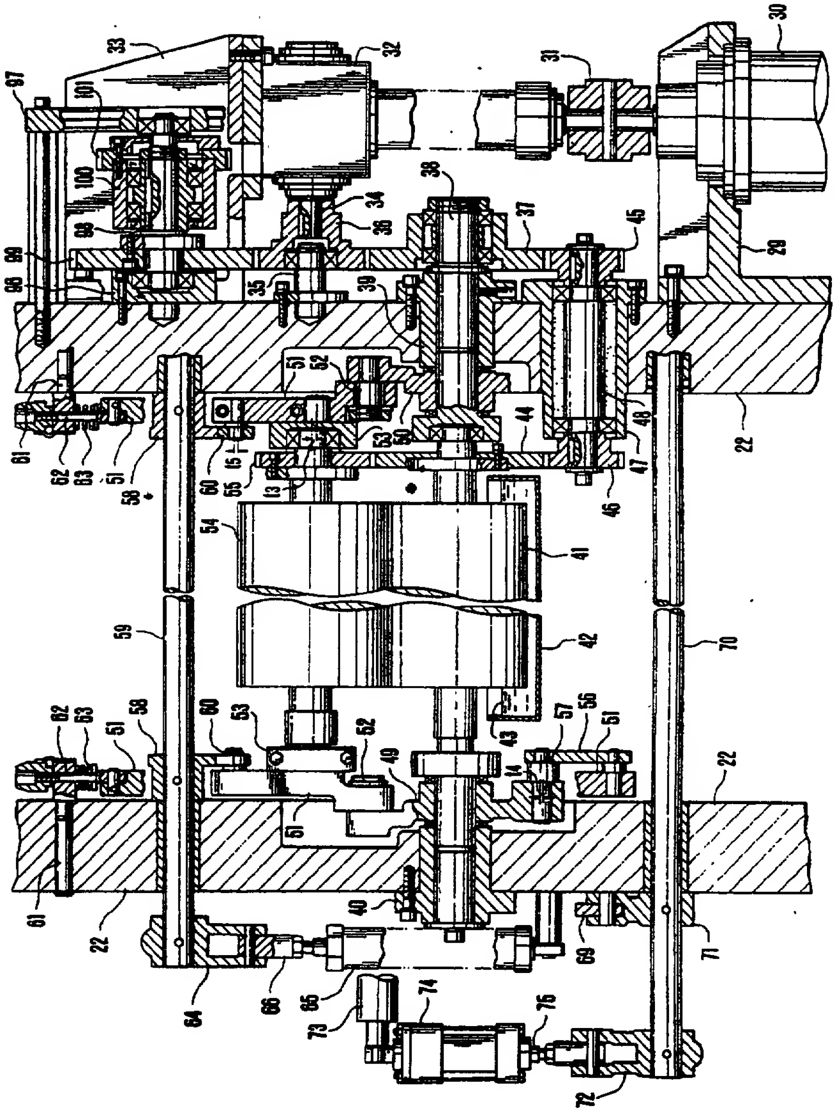
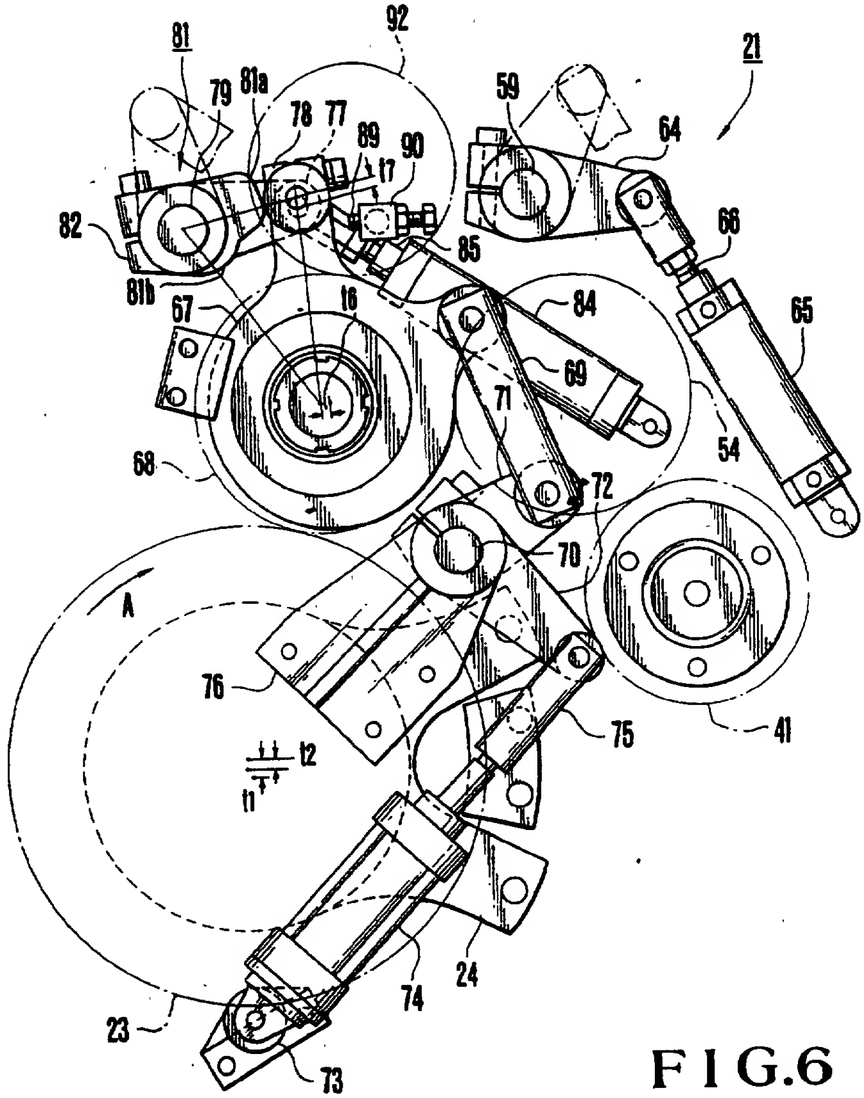


FIG.5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t7
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t6
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69
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t2
t1
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23
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FIG.6

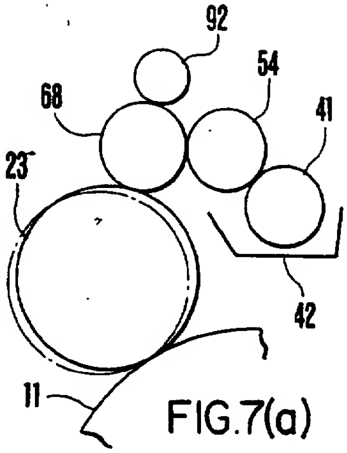

FIG.7(a)

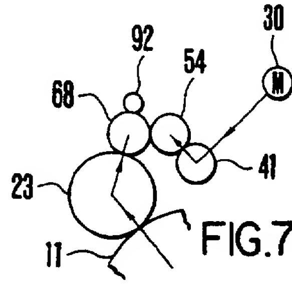

FIG.7(b)

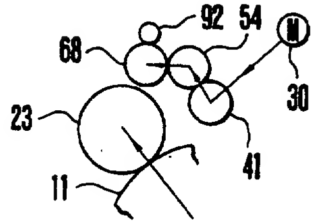

FIG.7(c)

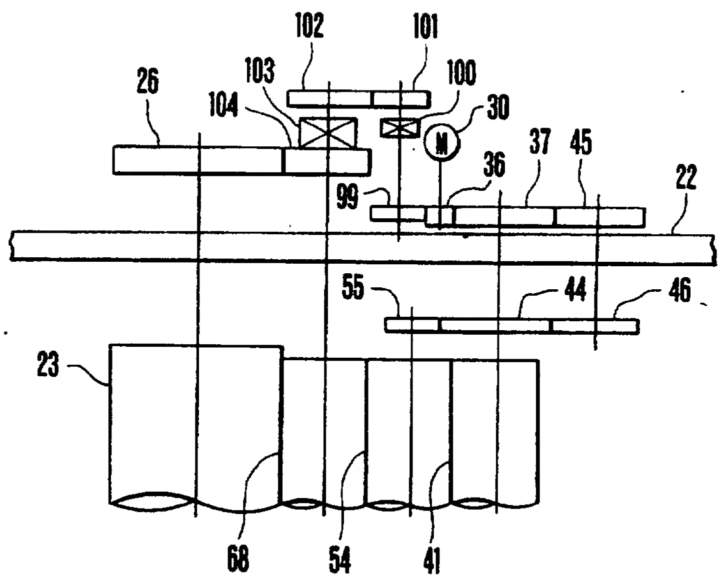

FIG.8

VARNISH COATER FOR PRINTED PRODUCT

BACKGROUND OF THE INVENTION

The present invention relates to a varnish coater disposed between a printing unit and a delivery apparatus of a rotary press or in an independent coating unit to apply varnish on a printed surface.

The surface of paper printed by a rotary printing press is not quickly dried and can be contaminated in the subsequent processing. In a sheet-fed rotary printing press, offsetting tends to be caused when printed sheets are stacked. In order to solve these problems, conventionally, a dryer is arranged in a delivery path of the printed products, or a powder is sprayed on the printed paper surfaces. However, in this case, the dryer becomes large, and powder spraying results in surface roughening of the printed surface. Surface roughening tends to entail a loss of gloss and subsequent poor printing. Instead of these techniques, varnish is applied to the printed surface to prevent the surface from being contaminated and to give it gloss. Varnishing is performed in printed products such as covers of books, catalogs and pamphlets which require an aesthetic effect.

The varnish coater is used as an independent apparatus. However, recently, the varnish coater is generally disposed in a delivery path of a printing press to shorten a coating time and an associated operation time for restacking the printed sheets and hence to improve the coating efficiency. The varnish coater generally has rollers in the same manner as that of a dampening apparatus for dampening a surface of a plate mounted on a plate cylinder of the printing unit. Varnish stored in a varnish pan is supplied to a surface of a blanket cylinder through the rollers. The varnish is transferred to a sheet passing between the blanket cylinder and an impression cylinder.

However, in the conventional varnish coater of this type, there arise problems in respect to a rotation transmission mechanism of each roller and a nonuniform thickness of a varnish film caused thereby. The printing press is stopped when the sheets are restacked, or a stack board is replaced, or an underlay for a blanket of the blanket cylinder is adjusted due to a change in paper size. In such a case, the blanket cylinder is separated from the impression cylinder, while the rollers used for applying varnish continue to rotate to prevent varnish from hardening before the restart time.

It is occasionally required that the blanket cylinder be driven from the drive line side of the press, and that the rollers consisting of a pan roller (upsteam roller), a metering roller and a form roller be driven by another variable motor so as to adjust the thickness of a varnish film. When the above operation is performed, however irregular rotation occurs between the blanket cylinder and the form roller which are driven by the different drive sources, thus resulting in an irregular thickness of the varnish film. However, when the form roller is coupled to the blanket cylinder through a gear, the form roller must be stopped when the blanket cylinder is stopped for cleaning and adjustment of the underlay of the blanket. As a result, the varnish on the outer surface of the form roller is hardened, and the form roller must also be cleaned, resulting in inconvenience.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a varnish coater capable of preventing irregular rotation between a blanket cylinder and a form roller to obtain a uniform thickness of a varnish film and hence to improve quality of printed products.

It is another object of the present invention to provide a varnish coater capable of preventing varnish on the form roller from being hardened while the blanket cylinder is stopped.

It is still another object of the present invention to provide a varnish coater capable of simultaneously cleaning the blanket cylinder and the form roller.

It is still another object of the present invention to provide a varnish coater capable of minimizing wasted paper by separating the blanket cylinder from the form roller to check varnishing, thereby improving the coating efficiency.

It is still another object of the present invention to provide a low-cost varnish coater which eliminates a need for electrical control, thereby simplifying maintenance procedures and preventing erroneous operation.

In order to achieve the above and other objects of the present invention, there is provided a varnish coater for a printed product, comprising:

upstream rollers for picking up and metering varnish;

a form roller which is brought into contact with one of the upstream rollers to receive the varnish therefrom;

a blanket cylinder which is selectively brought into contact with the form roller and an impression cylinder;

a main drive source for driving the impression cylinder and selectively driving the form roller;

a subdrive source for driving the upstream rollers and selectively driving the form roller;

first and second one-way clutches arranged between the blanket cylinder and the form roller and between the form roller and the subdrive source, respectively; and

a gear mechanism for selectively transmitting a rotational force to the form roller.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a four-color sheet-fed offset rotary printing press;

FIG. 2 is a schematic side view of a fourth color printing unit and a coating unit of the rotary printing press shown in FIG. 1;

FIG. 3 is a side view of a varnish coater of the coating unit shown in FIG. 2 according to an embodiment of the present invention;

FIG. 4 is a developed sectional view of a portion including a blanket cylinder and a form roller of the varnish coater shown in FIG. 3;

FIG. 5 is a developed sectional view of a portion including a pan roller and a metering roller of the varnish coater shown in FIG. 3;

FIG. 6 is a side view of a throw-on and -off mechanism for rollers in correspondence with the portion shown in FIG. 3 when viewed from the outside of the frame;

FIGS. *7a–7c* are a representation for explaining roller driving; and

FIG. 8 is a schematic representation of a roller drive unit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 2, a four-color sheet-fed offset rotary printing press 1 comprises a sheet feeder 2, four color printing units 3, a coating unit 4 and a deliv-

ery apparatus 5. These components are separately assembled and constitute the rotary printing press 1. Each printing unit 3 has a plate cylinder 6 having a printing plate thereon, an inking apparatus (not shown) for supplying a corresponding ink to the cylinder surface, and a dampening apparatus 7 for supplying dampening water to dampen the cylinder surface. A blanket cylinder 8 is brought into contact with each plate cylinder 6 on which an image is formed by utilizing the corresponding color ink and water. The image on the plate cylinder 6 is transferred to the blanket cylinder 8 upon relative rotation therebetween. In each printing unit 3, an impression cylinder 9 having a diameter twice that of the blanket cylinder 8 is brought into contact therewith. A transfer cylinder 10 having the same diameter as the impression cylinder 9 is sandwiched between adjacent impression cylinders 9 of the corresponding printing units 3. An impression cylinder 11 having a diameter twice that of a blanket cylinder 23 (having the same construction as the blanket cylinder 8) of the coating unit 4 is disposed to be in contact with the blanket cylinder 23 and at the same level as the other impression cylinders 9 of the printing units 3. A transfer cylinder 12 is sandwiched between the impression cylinder 9 of the fourth color printing unit 3 and the impression cylinder 11 of the coating unit 4. Paper sheets 13 stacked on the feed table of the sheet feeder 2 are taken up by a sheet pick-up device (not shown) and are fed one by one onto a feedboard 14. Each sheet 13 is gripped with grippers of the first color impression cylinder 9 by means of a swing gripper. The sheet 13 is printed by the blanket cylinders 8 with four colors while the sheet 13 is sequentially fed by the transfer cylinders 10 and the corresponding impression cylinders 9. The printed sheet is then gripped by grippers of the impression cylinder 11 and is wound therearound.

The delivery apparatus 5 comprises a delivery cylinder 15 which is brought into contact with the impression cylinder 11, and a pair of right and left sprockets 16 which are coaxially mounted on the delivery cylinder 15. Delivery chains 19 each having grippers at equal intervals are respectively looped between the right and left sprockets 16 and front end sprockets 18 of a delivery frame 17. The sheet 13 gripped by the grippers of the impression cylinder 11 is gripped by the grippers of the chains 19 and transferred thereby. The sheet 13 is released from the grippers of the chains onto a stack board 20.

The coating unit 4 having the construction described above has a varnish coater 21 to be described below.

Referring mainly to FIG. 4, the blanket cylinder 23 having the same diameter as that of the blanket cylinder 8 is rotatably supported by right and left frames 22, respectively, through pairs of antifriction bearings 24 and plain bearings 25. The blanket cylinder 23 is rotated in the direction indicated by arrow A (FIG. 3) upon rotation of a cylinder gear 26 coupled to a driving source. The axes of the bearings 24 and 25 are respectively deviated by distances t1 and t2 with respect to the axis of the blanket cylinder 23. A lever 27 pivotally mounted on the corresponding rolling bearing 24 of the frame 22 is reciprocated by means of an air cylinder to bring the blanket cylinder 23 into contact with or separate it from the impression cylinder 11. A lever 28 pivotally mounted on the plain bearing 25 is reciprocated by a handle to adjust the contact pressure between the blanket cylinder 23 and the impression cylinder 11.

Referring mainly to FIG. 5, a DC variable motor 30 is supported and mounted on a bracket 29 fixed on the outer surface of one of the frames 22. A gear box 32 coupled to the shaft of the motor 30 through a coupling 31 is supported and mounted on a bracket 33 fixed on the outer surface of this frame 22. A driving gear shaft 34 is coupled to the motor shaft through a bevel gear which is disposed in the gear box 32 to be perpendicular to the motor shaft. A driving gear 36 supported by a stud 35 which extends outward from the frame 22 is fixed on the driving gear shaft 34. A gear shaft 38 is supported on the frame 22 through a bearing 39 to rotatably support an intermediate gear 37 meshing with the driving gear 36. One end of a pan roller 41 is rotatably supported by the bearing portion of the gear shaft 38 extending inwardly of the frame 22. The other end of the pan roller 41 is supported by a bearing 40 of the opposing frame 22. The pan roller 41 is dipped in varnish 43 stored in a varnish pan 42. A pan roller gear 44 is fixed on a collar in the vicinity of the gear shaft 38. Reference numerals 45 and 46 denote gears which respectively mesh with the intermediate gear 37 and the pan roller gear 44 to transmit a rotational force of the intermediate gear 37 to the pan roller 41. The gears 45 and 46 are mounted on a gear shaft 48 supported by a bearing 47 which is mounted on the frame 22. The pan roller 41 rotates in a direction indicated by arrow B (FIG. 3). L-shaped roller arms 49 and 50 (the shape of the roller arm 49 is illustrated in FIG. 3 in detail) are movably mounted between the collar of the pan roller 41 and the bearing 40 and between the collar of the gear shaft 38 and the bearing 39 through thrust bearings, respectively. Inverted T-shaped arms 51 (the shape thereof is illustrated in FIG. 3 in detail) are pivotally mounted through pins 52 on corresponding free ends of the L-shaped roller arms 49 and 50, respectively. A bearing 53 is pivotally mounted on the free end of each of the T-shaped arms 51 such that the axis of the bearing 53 is deviated by a distance t3 (FIGS. 3 and 5) with respect to the shaft of a metering roller 54 having an elastic surface. Therefore, the roller 54 is supported by the bearings 53 and is brought in contact with the pan roller 41. A gear 55 mounted on the end portion of the shaft of the roller 54 is meshed with the pan roller gear 44, so that the roller 54 is rotated in the direction indicated by arrow C (FIG. 3). Bolts are loosened to pivot the bearings 53 so as to adjust a nip pressure acting on the pan roller 41.

One of the roller arms 49 is coupled to the corresponding T-shaped arm 51 through a lever 56 having an eccentric portion indicated by a distance t4 (FIGS. 3 and 5). A pin 57 of the eccentric portion is manually pivoted to throw on/off the metering roller 54 with respect to the pan roller 41. Reference numeral 58 denotes cams each having a large diameter portion 58*a* (FIG. 3) and a small diameter portion 58*b* (FIG. 3). The cams 58 are mounted on end portions of a cam shaft 59 mounted across the right and left frames 22. These end portions are adjacent to the inner surface portions of the right and left frames 22, respectively. Rollers 60 eccentrically (indicated by a distance t5) mounted on the free ends of the T-shaped arms 51 are in contact with the cam surfaces of the cams 58, respectively. Pivotal spring shafts 62 are mounted on studs 61 extending inward from the frames 22. One end of each of pivotal spring shafts 62 is pivotally mounted on the corresponding T-shaped arm 51. The T-shaped arms 51 urge the rollers 60 which tend to abut against the cams 58 by

means of compression coil springs 63 mounted on the spring shafts 62, respectively. A piston rod 66 of an air cylinder 65 having an end mounted on the corresponding frame is pivotally coupled to the free end portion of a lever 64 fixed on the end of the cam shaft 59. When the piston rod 66 is moved to pivot the cams 58, the metering roller 54 can be brought into contact with or separated from the pan roller 41 through the rollers 60 and the T-shaped arms 51.

Referring again to FIGS. 3 and 4, eccentric bearings 67 (indicated by a distance t6 in FIG. 3) are respectively mounted on the frames 22 above the blanket cylinder 23. A form roller 68 is supported by the eccentric bearings 67 and is brought into contact with the blanket cylinder 23. As shown in FIG. 4, one end of a connecting lever 69 is coupled to an outwardly extended portion of one of the eccentric bearings 67, and the other end thereof is coupled to a lever 71 which is mounted on a lever shaft 70 mounted on the frame 22. An actuator end of a piston rod 75 of an air cylinder 74 pivotally coupled to the stud 73 extending outwardly from the frame 22 is coupled to a lever 72 fixed on one end of the lever shaft 70. When the piston rod 75 of the air cylinder 74 is moved to pivot the eccentric bearings 67 through the coupling lever 69 and the like, the form roller 68 can be thrown on/off with respect to the blanket cylinder 23. Referring to FIG. 6, reference numeral 76 denotes a bearing fixed on the bracket at the side of the frame 22 to support the lever shaft 70 outside the frame 22. As shown in FIG. 4, the roller shafts 77 are split-clamped to be pivoted. Inner rings of rollers 78 each comprising a ball bearing are respectively fixed at the eccentric portions deviated by distances t7 with respect to the axis of the roller shaft 77. Reference numeral 79 denotes a cam shaft supported by the right and left frames 22 respectively through eccentric bearings 80. As shown in FIG. 6, the position of the cam shaft 79 is preset such that the axes of the cam shaft 79, the roller 78 and the form roller 68 correspond to apexes of a right angled triangle. Cams 81 each having a large diameter portion 81*a* and a small diameter portion 81*b* are split-clamped on the cam shaft 79. In other words, the cams 81 are respectively pivotal about the eccentric bearings 80 through the cam shaft 79. A lever 82 is split-clamped on the projecting end of the cam shaft 79, and the actuator end of a piston rod 85 of an air cylinder 84 pivotally supported by the frame 22 through a stud 83 is pivotally coupled to the free end portion of the lever 82. Bolts 86 respectively extend from the extended portions of the eccentric bearings 80 which extend inside the frames 22. The bolts 86 respectively engage with nuts such that these bolts 86 are inserted in handles 88 supported by studs 87 so as not to move axially. When the handles 88 are turned to move the bolts 86 so as to turn the eccentric bearings 80, respectively, the cams 81 are eccentrically moved together with the cam shaft 79 to shift its axis. In this throw-on and -off mechanism of the form roller 68, when the piston rod 75 (FIG. 5) of the air cylinder 74 is shortened (i.e., when the eccentric bearings 67 are pivoted clockwise in FIG. 6), the form roller 68 is separated from the blanket cylinder 23. In this case, the eccentric direction of the bearings 67 is preset such that the form roller 68 is separated from the blanket cylinder 23 while the distance between the form roller 68 and the metering roller 54 is kept to be substantially constant. In the state shown in FIG. 6, the blanket cylinder 23 is in contact with the form roller 68. In this case, the piston rod of the air cylinder 84 is shortened, and the large diameter portion 81*a* of each cam 81 is in contact with the corresponding roller 78. The roller 78 is biased by an air pressure of the air cylinder 74 to abut against the corresponding cam 81. Furthermore, when the blanket cylinder 23 is removed and the form roller 68 is thrown on the blanket cylinder 23, the piston rod 85 of the air cylinder 84 is elongated to pivot the cams 81 counterclockwise. As a result, the rollers 78 are respectively brought into contact with the small diameter portions 81*b* of the cams 81 by means of the biasing force of the air cylinder 74. Therefore, the form roller 68 is held in a state wherein it contacts the blanket cylinder 23. In other words, in the throw-on and -off positions of the blanket cylinder 23, the contact forces of the form roller 68 with respect to the blanket cylinder 23 are limited by the large diameter portions 81*a* and the small diameter portions 81*b* of the cams 81. Adjustment of these contact forces is effected by the movement of the cam 81 caused by the turning of the handle 88. Referring to FIG. 4, reference numeral 89 denote off-position stoppers which are screwed in studs 90 on the frames 22, respectively. When the blanket cylinder 23 is located in the throw-on position, the piston rod 75 of the air cylinder 74 is shortened, and the eccentric bearings 67 are respectively pivoted until they abut against the stoppers 89. Therefore, the throw-off position of the form roller 68 can be defined with respect to the throw-on position of the blanket cylinder 23. Referring to FIG. 4, reference numeral 91 denotes stoppers for defining the eccentric pivotal movement of the cams 81 when the lever 82 respectively abuts against the stoppers 91. As shown in FIG. 3, a rider roller 92 is supported at each end thereof by an arm 94 pivotal about a pin 93 on the side of the frame 22 and is brought in tight contact with the form roller 68. The arm 94 swings upon pivotal movement of a cam 95 by means of a handle (not shown), so that the rider roller 92 can be thrown on/off with respect to the form roller 68.

The drive mechanism of the motor 30, the cylinder gear 26 and the form roller 68 will be described with reference to mainly FIGS. 7 and 8.

One end of a clutch shaft 98 is supported by a bearing 96 fixed on the frame 22 in the vicinity of the motor 30, and the other end thereof is supported by a bracket 97 extending from the frame 22. A gear 99 is fixed on the clutch shaft 98 and is meshed with the driving gear 36 to transmit rotation of the motor 30 to the clutch shaft 98. A clutch gear 101 fixed on a one-way clutch 100 (to be described in detail later) on the clutch shaft 98 is meshed with a form roller gear 102 fixed in the end portion of the roller shaft of the form roller 68. The one-way clutch 100 has a known structure capable of transmitting a rotational force in only one direction. In this embodiment, the form roller 68 is a driven member, so that the rotational force of the motor 30 is transmitted only to the form roller 68. A one-way clutch 103 having the same construction as the one-way clutch 100 is arranged in an end portion of a roller shaft of the form roller 68. A clutch gear 104 coupled to the one-way clutch 103 is meshed with the cylinder gear 26 of the blanket cylinder 23. In this case, the form roller 68 is the driven member for the one-way clutch 103, so that the rotational force of the blanket cylinder 23 is transmitted only to the form roller 68. In this manner, the form roller 68 is selectively driven by the motor 30 and the blanket cylinder 23 through the one-way clutches 100 and 103; the form roller 68 does not simultaneously receive the rotational forces through the one-way

clutches 100 and 103. Either of the one-way clutches 100 and 103 which transmits a higher rotational speed is coupled to the form roller 68, and the other one of the one-way clutches 100 and 103 which transmits a lower rotational speed is decoupled from the form roller 68.

Referring to FIG. 7(*a*), the solid line position of the blanket cylinder 23 is defined as a throw-on position with respect to the form roller 68 and the impression cylinder 11. FIG. 7(*b*) shows a rotation transmission path when the blanket cylinder 23 is located in the throw-on position. In this case, the pan roller 41 and the metering roller 54 are driven by the motor 30, and the form roller 68 is driven by the impression cylinder 11 and the blanket cylinder 23 through the one-way clutch 103. Therefore, the one-way clutch 100 is decoupled from the form roller 68. Referring again to FIG. 7(*a*), the dotted line position of the blanket cylinder 23 is defined as a throw-off position with respect to the form roller 68. FIG. 7(*c*) shows a rotation transmission path when the blanket cylinder 23 is located in the throw-off position. In this case, the form roller 68 is driven by the motor 30 through the pan roller 41 and the metering roller 54 via the one-way clutch 100. Only the blanket cylinder 23 is driven by the impression cylinder 11. Therefore, the one-way clutch 103 is decoupled from the form roller 68.

The operation of the varnish coater 21 having the arrangement described above will now be described. The motor 30 of the varnish coater 21 is started to perform the coating operation while the blanket cylinder is located at the throw-off position. The cams 58 are pivoted by the air cylinder 65 to abut the rollers 60 against the small diameter portions 58*b* of the cams 58, respectively, so that the metering roller 54 is brought into tight contact with the pan roller 41 and the form roller 68 by means of the biasing forces of the compression coil springs 63. In this case, the piston rod 75 of the air cylinder 74 is elongated so that the rollers 78 of the eccentric bearings 67 are respectively brought into tight contact with the large diameter portions 81*a* of the cams 81. The form roller 68 is located in the throw-on position. However, since the blanket cylinder 23 is located in the throw-off position, the form roller 68 is separated from the blanket cylinder 23. In this case, the rotation of the motor 30 is transmitted to the pan roller 41 and the metering roller 54 through the bevel gears in the gear box 32, and the gears 36, 37, 45, 46, 44 and 55. The rotation of the motor 30 is also transmitted to the form roller 68 through the gears 36 and 99, the one-way clutch 100 and the gears 101 and 102. The blanket cylinder 23 is separated from the impression cylinder 11, and these cylinders are stopped. Upon rotation of the above-mentioned rollers, the varnish 43 is drawn by the pan roller 41 from the varnish pan 42. A thickness of the varnish film is adjusted upon contact between the pan roller 41 and the metering roller 54. The varnish film having a predetermined thickness is transferred to the form roller 68. Varnish circulates through the pan roller 41, the metering roller 54 and the form roller 68. When the rotary printing press is started to feed a sheet 13 onto the feedboard 14 by means of the automatic feeder 2, the blanket cylinders 8 of the printing units 3 are located in the throw-on positions, so that the sheet 13 is subjected to four-color process printing through the blanket cylinders and the corresponding impression cylinders 9. The printed sheet is fed toward the coating unit 4. When the printed sheet reaches the coating unit 4, the plain bearings 25 are pivoted in response to the command from a timing controller, so that the blanket cylinder 23 is located in the throw-on position, and that the blanket cylinder 23 is brought into tight contact with the impression cylinder 11 and the form roller 68. Varnish circulating between the form roller 68 and the pan roller 41 is transferred to the blanket cylinder 23 and is applied to the printed sheet passing between the blanket cylinder 23 and the impression cylinder 11. The coated sheet 13 is fed by the delivery chains 19 and is stacked on the stack board 20. In the throw-on position of the blanket cylinder 23, the rotational force is transmitted from the motor 30 to the form roller 68 through the one-way clutch 100. At the same time, since the blanket cylinder 23 is located in the throw-on position, the rotational force of the blanket cylinder 23 is transmitted to the form roller 68 through the gears 26 and 104 and the one-way clutch 103. The rotational speed of the blanket cylinder 23 is higher than that of the motor 30, so that only the rotational force of the blanket cylinder 23 is transmitted to the form roller 68. The one-way clutch 100 is decoupled from the form roller 68.

When the coating operation is completed and the stack board 20 of the delivery apparatus 5 is replaced with an empty stack board, or the underlay of the blanket is adjusted if the blanket becomes thin, sheet feeding is stopped. In this condition, the blanket cylinders 8 of the printing units are moved in the throw-off positions, and the blanket cylinder 23 is simultaneously thrown off with respect to the impression cylinder 11 and the form roller 68. In this case, the cylinder gear 26 is slightly meshed with the gear 104, and the motor 30 continues to rotate. Therefore, the form roller 68 continues to be driven by the blanket cylinder 23 through the one-way clutch 103. At the same time, the pan roller 41 and the metering roller 54 continues to be driven by the motor 30, so that the varnish 43 circulates in a path between the varnish pan 42 and the form roller 68 and will not be hardened. In the case of adjusting the underlay of the blanket of the blanket cylinder 23, the rotary printing press is stopped, and the blanket cylinder 23 is cleaned and the underlay is adjusted. In this case, the form roller 68 is driven by the motor 30 through the one-way clutch 100. After the underlay is adjusted, the rotary printing press is started. When the air cylinder 84 is actuated to elongate the piston rod 85, the cams 81 are rotated counterclockwise (FIG. 6) through about 90°. In this case, the eccentric bearings 67 are biased by the air cylinder 74 and are rotated until the rollers 78 respectively abut against the small diameter portions 81*b* of the cams 81. Therefore, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the off position, and the varnish under circulation is transferred to the blanket cylinder 23. The cylinder gear 26 is meshed with the gear 104, so that the form roller 68 is driven by the blanket cylinder 23 through the one-way clutch 103 at a speed higher than the rotational speed of the motor 30 since the rotation of the impression cylinder is transmitted through meshing between the gears 26 and 104 even if the blanket cylinder 23 is located in the throw-off position. Thereafter, when the sheet 13 is fed and reaches the blanket cylinder 23, the air cylinders 74 and 84 are actuated in response to predetermined timing signals from the timing controller. As a result, the rollers 78 are respectively brought into tight contacts with the large diameter portions 81*a* of the cams 81, and the blanket cylinder 23 is located in the throw-on position. Therefore, the form roller 68 is brought into tight contact with the blanket

cylinder 23 by a contact pressure preset by the cams 81 and the rollers 78, thereby to restore the coating condition which existed before sheet feeding was stopped. In order to simultaneously clean the form roller 68 and the blanket cylinder 23, the form roller 68 is brought into contact with the blanket cylinder 23 which is located in the throw-off position. The form roller 68 is driven through the blanket cylinder 23. In addition, in order to manually clean the blanket cylinder 23, the blanket cylinder 23 is located in the throw-off position, and the impression cylinder 11 is stopped. The blanket cylinder 23 can be washed while the form roller 68 is located in the off state with respect to the blanket cylinder 23. Therefore, the form roller 68 is driven by the motor 30.

The present invention is not limited to the particular embodiment described above. It is essential to rotate the blanket cylinder in synchronism with the form roller. For example, the form roller 68 can be brought into tight contact with only the pan roller 41, and the metering roller 54 can be brought into tight contact with only the pan roller 41. The same effect as in the above embodiment can be obtained even in this modification. The rotational direction of the rollers is not limited to the way as described above.

As is apparent from the above embodiment, in the varnish coater for the printed product, the blanket cylinder and the form roller, and the rollers located in the upstream of the form rollers are driven by the separate drive sources. The one-way clutches are arranged between the blanket cylinder and the form roller and between the form roller and the upsteam drive source, respectively. The form roller is selectively driven by one of the blanket cylinder drive source and the upstream drive source. In addition, the form roller is driven by one of the drive sources which has a higher rotational speed. The form roller can be driven without damage irrespective of the throw-on and -off operation between blanket cylinder and the form roller. Therefore, the coating operation can be properly performed, varnish can be applied to the rollers while the blanket cylinder and the form roller are respectively located in the throw-off positions, and the varnishing operation can be checked while the blanket cylinder and the form roller are respectively located in the throw-off and throw-on positions. These operations can be performed without irregular rotation between the blanket cylinder and the form roller, thereby eliminating the nonuniform thickness of the varnish film and hence improving the quality of the printed products. In addition, while the blanket cylinder is stopped, the form roller can be continuously rotated together with the metering roller and the pan roller, thereby preventing hardening of varnish. Furthermore, varnishing can be checked while the blanket cylinder is located in the throw-off position, thereby decreasing occurrence of wasted paper and improving the coating operation. In addition to these advantages, the electrical control system is not required, so that a low-cost varnish coater can be obtained, the maintenance procedures can be simplified, and the erroneous operation can be eliminated.

What is claimed is:

1. A varnish coater for a printed product, comprising:
upstream rollers for picking up and metering varnish;
a form roller which is brought into contact with one of said upstream rollers to receive the varnish therefrom;
a blanket cylinder which is selectively brought into contact with said form roller and an impression roller;
a main drive source for driving said impression roller and selectively driving said form roller;
a subdrive source for driving said upstream rollers and selectively driving said form roller;
first and second one-way clutches arranged between said blanket cylinder and said form roller and between said form roller and said subdrive source, respectively; and
a gear mechanism for selectively transmitting a rotational force to said form roller;
wherein said subdrive source drives said form roller via a subdrive source gear, a first transfer gear meshed with the subdrive source gear, said second one-way clutch, a second transfer gear meshed with a form roller gear, and said form roller gear, when said blanket cylinder is separated from said form roller, said subdrive source gear, said first and second transfer gears and said form roller gear being included in said gear mechanism.

2. A varnish coater according to claim 1, wherein said main drive source drives said blanket cylinder through said impression cylinder, and said blanket cylinder drives said form roller through a blanket cylinder gear, a first one-way clutch gear meshed with said blanket cylinder gear and, said first one-way clutch when said blanket cylinder is held in a throw-on position, and said blanket cylinder gear, said first one-way clutch gear, being included in said gear mechanism.

3. A varnish coater according to claim 1, wherein said form roller is driven by one of said main drive source and said subdrive source which has a higher rotational speed.

4. A varnish coater according to claim 3, wherein said main drive source has a rotational speed higher than that of said subdrive source.

5. A varnish coater according to claim 1, wherein said upstream rollers comprise a metering roller and a pan roller, said pan roller being dipped in varnish.

* * * * *

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United States Patent [19]

Jahn

[11] Patent Number: 4,615,293

[45] Date of Patent: Oct. 7, 1986

[54] MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE

[75] Inventor: Hans-Georg Jahn, Wiesenbach, Fed. Rep. of Germany

[73] Assignee: Heidelberger Druckmaschinen AG, Heidelberg, Fed. Rep. of Germany

[21] Appl. No.: 636,916

[22] Filed: Aug. 2, 1984

[30] Foreign Application Priority Data

Aug. 3, 1983 [DE] Fed. Rep. of Germany 3327993

[51] Int. Cl.[4] B05C 1/02; B05C 11/10

[52] U.S. Cl. 118/46; 118/212; 118/221; 118/249; 118/255; 118/262

[58] Field of Search 118/46, 221, 222, 255, 118/262, 212, 249

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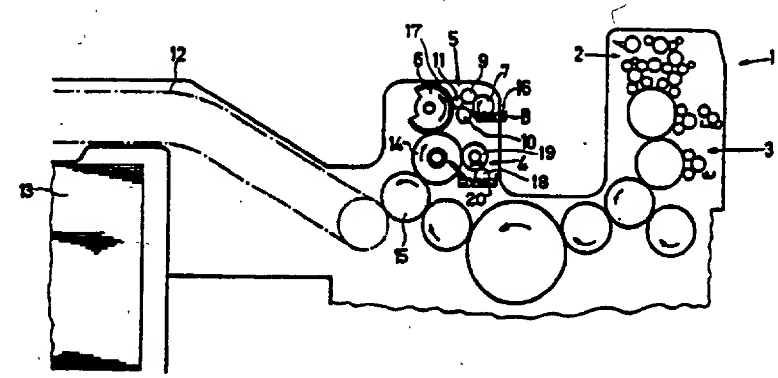
Primary Examiner—Evan K. Lawrence

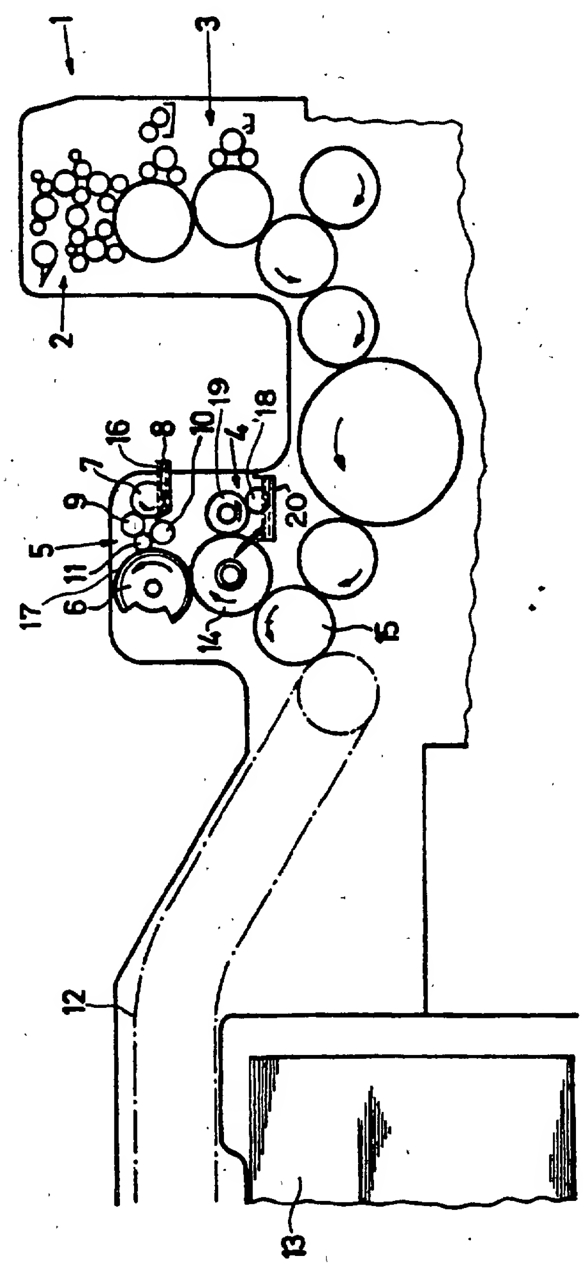
Attorney, Agent, or Firm—Herbert L. Lerner; Laurence A. Greenberg

[57] ABSTRACT

In a printing machine, a medium applicator disposed downstream of printing units of the machine, in travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

3 Claims, 1 Drawing Figure

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MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE

The invention relates to a medium applicator in a printing machine and, more particularly, to such a medium applicator which is disposed downstream of printing units of a printing machine, as viewed in travel direction through the machine of a sheet being printed therein, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium. A medium applicator of this general type has been described in my commonly owned co-pending application Ser. No. 626,732 filed July 2, 1984, now abandoned.

A lacquering or varnishing device in printing machines has become known heretofore from German Published Non-Prosecuted Application No. (DE-OS) 30 46 257. This device includes a lacquer storage tank or supply container and a scooping roller dipping into this tank. The lacquer taken up by the scooping roller is fed in metered fashion to an applicator roller. Two doctor rollers, by means of which a format-related lacquer feed occurs, can be set close to the scooping roller. A ductor blade applicable against the metering roller is also provided. This ductor blade serves to wipe superfluous lacquer from the metering roller and to return it to the supply container.

A specific disadvantage of this heretofore known device is that the lacquer is fed to the varnishing or lacquering cylinder via a distributor roller and an application roller. Because of the relatively long transport distance which the lacquer has to cover over many rollers until it reaches the printed sheet, the lacquer begins to set i.e. no quick-drying lacquers can be used. Due to this limitation to slowly drying lacquers, when the sheet is delivered the reverse side or back of the next following sheet will smear the lacquer and thus paste the sheets together. Consequently, no full sheet piles can be set up, because the pile weight which is built up at the delivery end and which applies a load to the individual sheets also limits the lacquer layer thickness.

In the device described in German Pat. No. 23 45 183 for applying a medium there are provided a dipping roller, a metering roller, an applicator roller, a back-pressure cylinder, a form cylinder and another applicator roller. The two applicator rollers, the dipping roller and the metering roller are combined into a common structural unit. Within this structural unit, either the dipping roller with the form cylinder or the first applicator roller with the form cylinder or the second applicator roller with the back-pressure cylinder can cooperate.

A disadvantage of this last-mentioned construction is that the lacquer must first be fed to the printed material via the form cylinder. The platen mounted on the clamping device at the form cylinder forms a channel in which the lacquer accumulates after a given operating time. This lacquer-accumulation results in an irregular lacquer application due to dripping of the lacquer down onto the printed material.

German Pat. No. 20 20 584 is based upon a device for avoiding smearing of the ink due to lacquering. By means of a lacquering unit, the lacquer is applied to a printing-unit cylinder. This printing-unit cylinder, which has the same diameter as that of the cylinders of the preceding printing units, transfers the lacquer to the printed material. The disadvantages referred to hereinbefore are also applicable to this construction and require additionally, time-consuming cleaning work to be performed on the rollers. Moreover, the construction of the printing unit is complicated by having to attach the lacquering unit to the rubber of blanket cylinder.

A further disadvantage of the state of art as exemplified by the references cited hereinbefore, is that, due to the directions of rotation of the rollers, the format-related wiping by the ductor blade cannot be observed, thus making impossible a precise wiping or removal of the superfluous lacquer material.

It is an object of the invention of the instant application to provided a further improvement over the construction in my aforementioned co-pending application in the form of a supplemental medium-applying device which is suitable especially for coating or lacquering surfaces which are interrupted or spaced from one another and, furthermore, to provide a supplementary medium applicator or lacquering unit for applying coatings or for lacquering with layers of any selected thickness.

With the foregoing and other objects in view, there is provided, in accordance with the invention, in a printing machine, a medium-applicator disposed downstream of printing units of the machine, in the travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

In this lacquering device or medium application, it is possible to apply medium or lacquer by means of a flexible relief or letterpress plate which is disposed on a plate cylinder. Fields or sections of the most varied size and shape are provided on this relief plate in order to perform the desired application of medium or lacquering of areas which are interrupted or spaced from one another.

In accordance with a further feature of the invention, the first, second and third rollers and the medium supply container associated therewith form a first-medium applying device, and the plate cylinder, the other assembly of rollers and the other supply container form a supplementary medium-applying device, and means are included for operating the first medium-applying device simultaneously with the supplementary medium-applying device.

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United States Patent [19]

DiRico

[11] **Patent Number:** **4,685,414**

[45] **Date of Patent:** **Aug. 11, 1987**

[54] **COATING PRINTED SHEETS**

[76] Inventor: **Mark A. DiRico**, 416 Adams St., Quincy, Mass. 02169

[21] Appl. No.: **719,474**

[22] Filed: **Apr. 3, 1985**

[51] **Int. Cl.**[4] **B05C 1/08**; B05C 11/10

[52] **U.S. Cl.** **118/46**; 118/211; 118/262

[58] **Field of Search** 118/46, 262, 261, 211; 101/352

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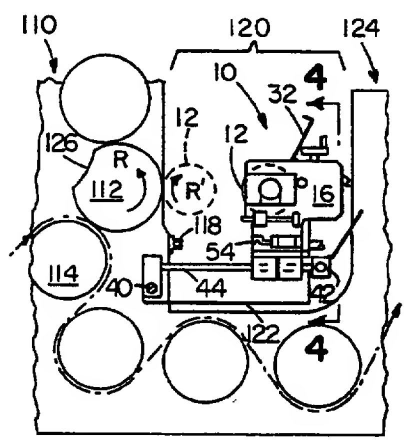
Primary Examiner—Evan K. Lawrence

[57] **ABSTRACT**

Apparatus for applying a liquid coating to the surface of a sheet workpiece and adapted for operation on-line with the last unit of a lithographic sheet printing press. The apparatus comprises: (1) a textured metering roller in a mount which is linearly movably attached to a support platform fixed adjacent the press unit, and extending between the last press unit and a remote point. The support platform allows movement of the metering roller and the mount between a first position in which the mount is continuously adjustably biased against the last press unit, and a second position, away from the last press unit to allow use of the last press unit as a lithographic press. The platform comprising longitudinal supports arranged generally perpendicular to a vertical plane through the axis of said metering roller, and the metering roller mount is movably supported and guided along the supports.

In the first position, the metering roller continuously delivers a smooth, uniform, metered amount of liquid material to the blanket roller of the printing press. The apparatus also includes a latch that allows the mount, with its attached metering roller, liquid coating supply, and metering roller rotation device, to be readily detached from and moved out of the way of the press unit, so that the press unit can be used as a lithographic press unit. A biasing latch and an adjustable stop allow the metering roller and mount to be readily and reliably returned, locked and biased in the first position.

8 Claims, 4 Drawing Figures



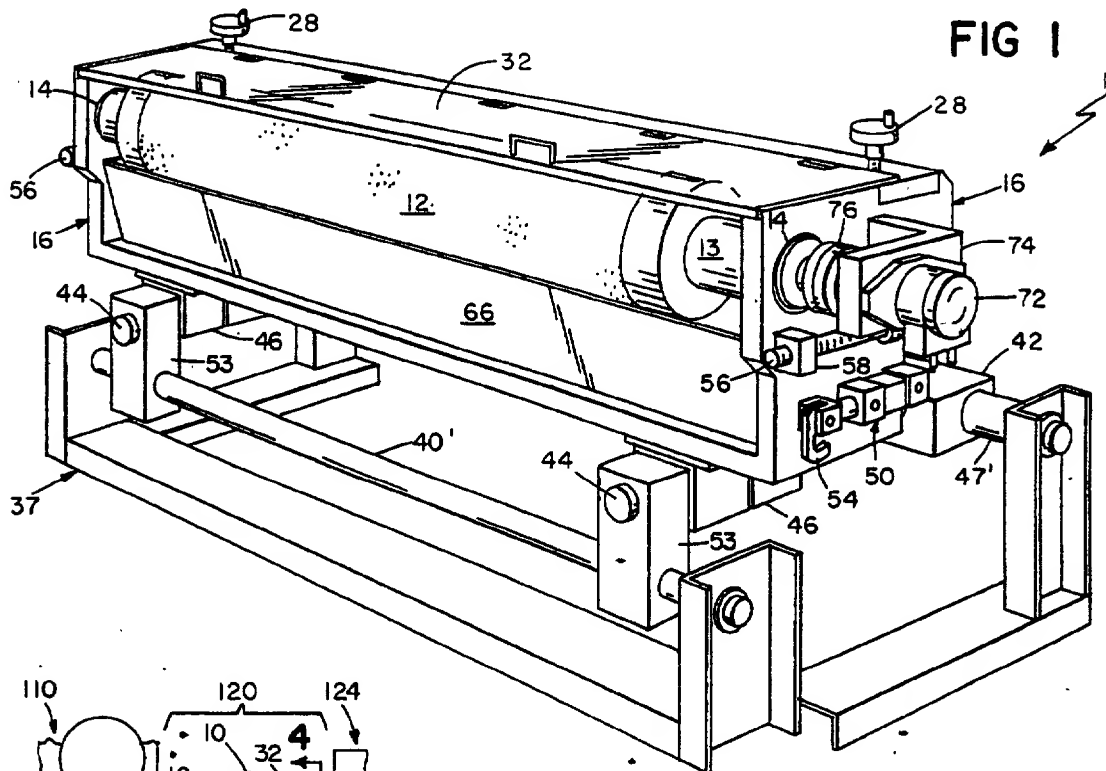


FIG 1

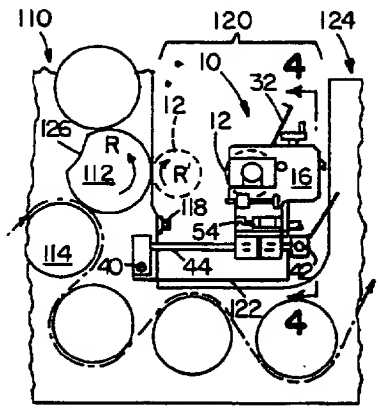


FIG 3

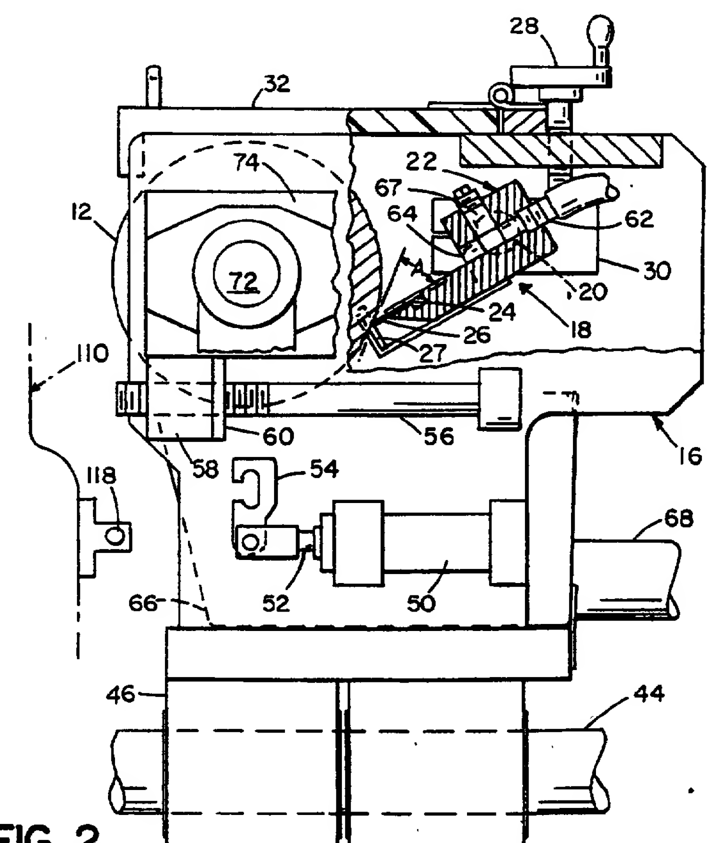


FIG 2

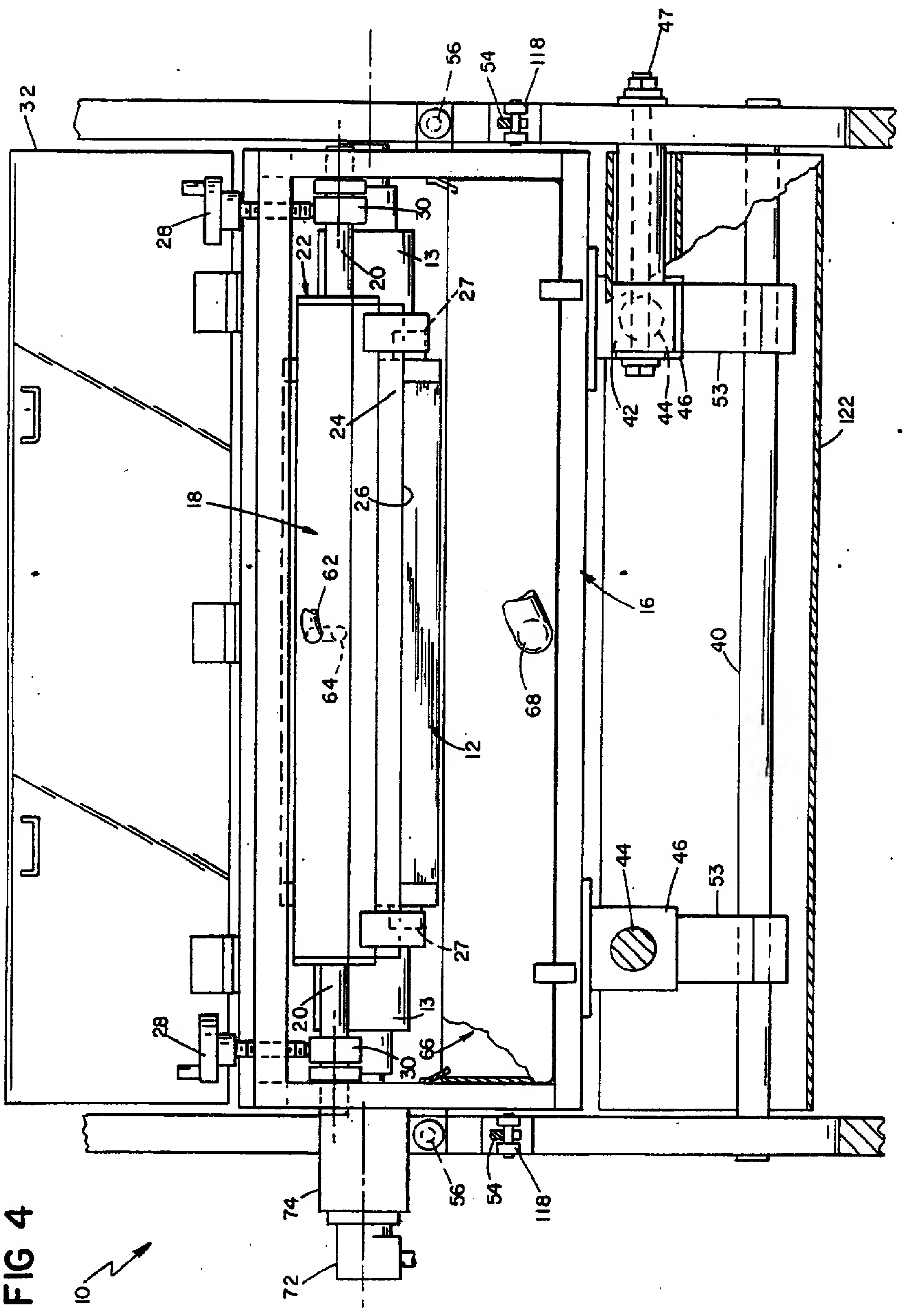


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FIG 4

COATING PRINTED SHEETS

BACKGROUND OF THE INVENTION

This invention relates to coating printed sheets.

In many applications it is desirable to apply a coating to a printed sheet. For example, a water soluble polymer finish may be applied to a workpiece printed by offset lithography to "dry" the sheet quickly by coating the surface while it is still tacky. This coating avoids the need for powder driers that may be cumbersome or air drying procedures that may be slow. Coatings are also useful for providing a glossy finish that improves the rub-resistance of the workpiece and improves its overall appearance. Finally, adhesive coatings may be applied to printed packaging; for example, heat-set adhesives may be applied to enable attachment of a feature such as the clear plastic bubble of a package used to display the product.

Application of coatings to a workpiece is made difficult by various requirements. For example, the coating should be uniform and its thickness should be controlled. Moreover, the coating should be applied quickly, before its vehicle evaporates causing it to thicken. Finally, it is desirable for the coater to operate "on-line" with the press that prints the workpiece to take full advantage of the fast-drying capability of coatings and generally to simplify the manufacture of printed coated workpieces.

Butler U.S. Pat. No. 4,270,483 discloses an on-line coating apparatus for attachment to a conventional offset lithographic printing press. The apparatus includes a set of rollers (i.e. pick-up roller **14** and application roller **16**) to deliver coating material from a reservoir **18** to a blanket roll **108**. A metering rod **40** meters the amount of coating transferred to application roller **16**.

An on-line coater sold by Norton Burdett Co. of Nashua, N.H. has a single roller driven directly by a D.C. motor. The roller is a gravure cylinder that transfers coating to a blanket cylinder. The coater is attached to a pivoting arm, and the unit can be pivoted away from the press unit when the coater is not in use.

Another on-line coater, sold by IVT Colordry, Inc. of Fairfield, Conn., applies coating from a reservoir pan to a blanket cylinder using a pick-up roller that delivers a metered coating supply to an applicator roller; the applicator roller applies the coating to the blanket cylinder of a press unit.

Kumpf U.S. Pat. No. 3,768,438 discloses a coater in which a fountain roller dips into a coating reservoir and transfers liquid coating material to a feed roller. The feed roller in turn transfers coating material to a coating roller that coats a sheet fed between the coating roller and a format roller.

SUMMARY OF THE INVENTION

The invention generally features apparatus to be mounted on-line with a printing press unit for coating the surface of a sheet workpiece with liquid material. The coating apparatus comprises a textured (e.g., engraved) metering roller or cylinder rotably mounted to be forced against the blanket roller of the press unit. A doctor assembly comprising an elongated blade edge is positioned against the engraved roller surface, and includes means to deliver the liquid material to the longitudinal engraved surface of the roller. The engraved metering roller delivers a metered amount of the liquid

to the blanket roller, which transfers the liquid material to the sheet workpiece.

Preferred embodiments of the apparatus include the following features. A hydraulic cylinder mounted on the coating apparatus pulls a piston rod that is clamped to the press unit, thus forcing the metering roller against the blanket roller. The printing press is an offset lithographic press having an indented region on the blanket roller surface, and the mounting means includes a stop to limit movement of the metering roller toward that indented region. The mounting means is movably attached to a platform so the coating apparatus is moveable away from the printing press unit when the coating apparatus is not in use. Specifically, the mounting means has bearings that slide along longitudinal support rails arranged to be generally perpendicular to a vertical plane through the metering roll axis. The doctor assembly includes means to deliver liquid coating from a liquid coating reservoir to an outlet positioned to deliver coating liquid to a central portion of the engraved surface adjacent the doctor blade; the outlet is positioned so that as the metering roll rotates, coating delivered from the outlet encounters the doctor blade before it encounters the blanket roller. The position of the doctor blade can be adjusted relative to the metering roll surface. A drip pan positioned below the doctor blade has an outlet to drain and recirculate coating material that flows from the ends of the metering roller and doctor assembly. A hydraulic motor is mounted to drive the metering roller directly, rotating it in a predetermined rotational direction.

The apparatus provides a compact, versatile and reliable means for coating printed sheets. Specifically, the apparatus can be added to an existing press unit without significant modification to the unit; and once added, the apparatus can be moved out of the way so that the press unit to which it is attached can be used for printing. This is particularly useful when the number of colors to be printed requires the use of the press unit to which the coater is attached.

The apparatus is capable of delivering a metered amount of coating to the blanket roller without the use of bulky complex metering systems and without serious clogging of the coating flow path. Versatility is achieved by using the blanket roller of an existing press unit, yet the apparatus can be detached easily from the press unit and moved out of the way. At the same time, when it is in use, the apparatus is stable and provides a steady even pressure against the blanket roller, notwithstanding the considerable range of forces and vibrations to which the metering roller is subject. The apparatus accommodates indentations in the blanket roller without suffering uneven compressive forces that could "squeeze" liquid coating from the blanket and cause streaking. Finally, the use of the hydraulic assist motor with a direct drive enables a smooth start up, delivering an even amount of coating to the blanket roller quickly after start-up without streaking that can be experienced with other drive systems.

Other features and advantages of the invention will be apparent from the following description of the preferred embodiment and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a coating apparatus supported independently and not attached to a press unit.

FIG. 2 is a side view of the coater of FIG. 1, with parts broken away and in section, including a portion of an adjacent press unit.

FIG. 3 is a highly schematic representation of the coater of FIG. 1 attached to a press unit.

FIG. 4 is a rear view of the coater of FIG. 1 with parts broken away and in section.

APPARATUS

FIG. 1 shows coating unit 10 separated from a press, as it would be in storage or in construction. As shown in FIGS. 2 and 3, coating unit 10 is adapted to attach to the most downstream unit 110 of a standard multi-unit offset lithograph press. Coating unit 10 has a single engraved roller 12 and shaft 13 rotably mounted on bearings 14 that are attached to a housing 16. When the coating unit is attached to press unit 110, the axis of roller 12 is parallel and horizontally aligned with the axis of blanket roller 112, and roller 12 contacts the blanket roller 112 so that roller 12 delivers liquid coating to blanket roller 112.

As shown best in FIG. 2, a doctor blade assembly 18 is adjustably mounted in housing 16 to deliver liquid coating to engraved roller 12 and to spread a metered level of the coating along the roller surface. Assembly 18 includes a rotably mounted axle 20 spanning housing 16 parallel to the longitudinal axis of roller 12. Mounted centrally on axle 20 is a rectangular housing 22 from which a blade clamp 24 extends. Doctor blade 26 is fixed in clamp 24 and is held against roller 12 at an angle. Blade 26 is blue spring steel about 0.007 inches thick, and it extends from clamp 24 about ½ inch. The set-up angle A (FIG. 2) is about 30°. Blade 26 is forced against roller 12 at a pressure of e.g. 25–30 pounds for a 60-inch blade (i.e. about 0.5 pounds per inch).

In FIG. 2, doctor blade assembly 18 also includes a fitting 62 communicating with a passage through doctor blade housing 22 to outlet 64. A plugged passage 67 in housing 22 allows access to the interior of the housing for cleaning. A drip pan 66 having an outlet 68 is positioned below roller 12 and doctor blade assembly 18.

Adjustment of blade 26 to roller 12 is achieved by two adjustment screws 28 which extend through the top of housing 16 at opposite ends thereof. Screws 28 extend to adjustment brackets 30 on axle 20. Because screws 28 are attached to brackets 30 at points off of the center of the axle 20, rotation of screws 28 will pivot axle 20 and brackets 30, changing the pressure between blade 26 and roller 12. Wipers 27 on assembly 18 at each end of roller 12 prevent liquid coating from building up on the ends of the roller 12.

Unit 10 also includes a clear cover 32 hinged to the top of housing 16 to protect roller 12.

As shown in FIGS. 3 and 4, housing 16 is movably mounted above the floor 122 of the well 120 between press unit 110 and downstream unit 124, which is, e.g., a rack for storing bundles of the finished workpieces. Specifically, housing 16 is mounted on bearing blocks 46 that slide on two parallel tie rods or rails 44 oriented perpendicular to the axis of roller 12. Rails 44 are supported at one end by blocks 53 that are adjustably mounted on cross shaft 40 of press unit 110. At their other ends, rails 44 are supported respectively by blocks 42 on shafts 47 fixed to press unit 110. As best shown in FIG. 3, shaft 40 and shafts 47 are integrated with the floor 122 of well 120. Shaft 40 is an existing shaft on unit 110. Shafts 47 are added to the unit to accommodate coater 10. (In FIG. 1, the coater 10 is shown separate from unit 110, as it might be stored or transported; rails 44 are supported by a frame 37 of metal beams that support shaft 40' and shafts 47').

Hydraulic cylinders 50 (one shown) are mounted on opposite sides of housing 16 to drive piston arms 52 and maintain proper pressure between roller 12 and roller 112. At one end of each piston arm 52 is a latch 54 that cooperates with a lug 118 on unit 110 to latch the coating unit to the press. Also fixed to each side of housing 16 is an adjustable stop screw 56 that is threaded through a block 58 and locked in place with lock nut 60. Cylinders 50 are connected to limit switches (not shown) to release the pressure between rollers 12 and 112 when the press is off impression.

On one side of housing 16 a hydraulic motor 72 is mounted to motor support 74 to drive roller 12 directly via coupling 76.

OPERATION

The coater is first locked into operation on press unit 110 by manually moving it along rails 44 toward unit 110 and rotating latch 54 to engage a lug on unit 110. In operation, when the press is off impression, hydraulic motor 72 rotates roller 12 as coating fluid is pumped under pressure from a fluid reservoir (not shown) to inlet opening 64 in the doctor blade assembly. From there, coating spreads over the engraved surface of roller 12 and is metered by the engraving and by doctor blade 26. A continuous flow of coating is maintained over the surface of roller 12, and excess coating is recovered through drip pan 66 and outlet 68 for recycling. In this way, sufficient flow is maintained to avoid clogging the flow path or roller with dried coating and to avoid starving the ends of the roller. The amount of coating carried by roller 12 can be adjusted by turning screw 28 to adjust the pressure between blade 26 and roller 12, as described above. When the press is on impression, hydraulic cylinders 50 serve to pull roller 12 against blanket roller 112 with a force that can be adjusted by adjusting the pressure in cylinders 50. As blanket rotates in direction R, friction turns roller 12 in the opposite direction R', without assistance from the motor 72.

As blanket roller 112 rotates, the indentation 126 on that roll encounters the nip between roller 12 and roller 112. It is undesirable to allow roller 12 to be forced into that indentation 126 by hydraulic cylinders 50. Stops 56 are adjusted to limit travel of coater housing 16 and prevent that from occurring. Stops can be finely adjusted to set the optimum pressure (for example about 40–50 pounds/linear inch) between roller 12 and roller 112.

A metered amount of liquid coating is delivered to blanket roller 112 at the nip between roller 112 and roller 12. Blanket roller 112 in turn delivers that coating to the workpiece as the workpiece travels through the nip between roller 112 and impression roller 114.

When the coater is not in use, latch 54 is released, and the coater is moved back along rods 44 away from roller 112.

More specifically, when using an acrylic water-based coating, a suitable engraved roller is a quadrangular cell cylinder, having about 165 lines/inch, each cell being about 60 microns in depth. Machine Engraving Division. Southern Gravure Service, Inc., Louisville, Ky., sells a suitable engraved roller. An acrylic water-based coating having about 25% solids can be applied to

achieve a dry coat weight of 0.6–0.9 pounds using a roll speed of about 350 rpm.

OTHER EMBODIMENTS

Other embodiments are within the following claims. For example, other doctor blade arrangements can be used to meter the load on roller 12; such as a system having dual, parallel blades having a coating inlet between the two blades. Other types of engraved cylinders may be used. Other types of press units may be used in conjunction with the coater, but offset lithographic sheet-feeding units are preferred.

I claim:

1. Apparatus for applying a liquid coating to the surface of a sheet workpiece, said apparatus being adapted for operation on-line with the last unit of a lithographic sheet printing press, said unit comprising a blanket roller having a surface indentation, said coating application apparatus comprising:

(1) a metering roller rotatably mounted in mounting means, said metering roller having a textured longitudinal surface, said mounting means being linearly movably attached to a support platform fixed adjacent said last press unit, and extending between the last press unit and a point remote from said unit, allowing movement of said metering roller and said mounting means between a first position in which said mounting means is continuously adjustably biased against said last press unit wherein said metering roller surface contacts said blanket roller, and a second position, away from said last press unit to allow use of said last press unit as a lithographic press, said platform comprising longitudinal supports arranged generally perpendicular to a vertical plane through the axis of said metering roller, said metering roller mounting means being supported by, guided by and movable along said supports;

(2) latch means, attached to the mounting means and positioned to lock said metering roller mounting means to said press unit in said first position, said latch means comprising a biasing means to adjustably bias said metering roller mounting means against said press unit, providing a steady even pressure between said blanket roller and said metering roller, wherein said mounting means further comprises a continuously adjustable stop to position said metering roller against said blanket roller and to prevent travel of said metering roller toward said surface indentation of said blanket roller as said blanket roller rotates, said latch being movable to provide quick release of said mounting means from said press unit to allow movement along said supports to said second position; and

(3) a metering member comprising means to control liquid coating on said textured metering roller surface;

(4) means attached to said mounting means to supply liquid coating material to the textured surface of said metering roller; and

(5) means attached to said mounting means to effect rotation of said metering roller;

whereby in said first position, said metering roller continuously delivers a smooth, uniform, metered amount of said liquid material to said blanket roller, said blanket roller transferring said liquid material to said sheet workpiece, said latch allowing said mounting means, with its attached metering roller, liquid coating supply means, and metering roller rotation means, to be readily detached from and moved out of the way of the press unit, so that the press unit can be used as a lithographic press unit, and said latch means and adjustable stop allowing said metering roller and mounting means to be readily and reliably returned,locked and biased in the same said first position.

2. The apparatus of claim 1 wherein said metering member comprises a doctor assembly, said assembly comprising an elongated blade edge positioned against said textured roller surface, said assembly further comprising said means to deliver said liquid coating material to said textured roller surface.

3. The apparatus of claim 1 wherein said latch means comprises a cylinder attached to said mounting means that adjustably forces said mounting means against said press unit.

4. The apparatus of claim 1 wherein said longitudinal supports comprise rail members, and said mounting means comprises bearings that slide along said rail members.

5. The apparatus of claim 2 comprising a drip pan positioned below said doctor assembly attached to said mounting means, said drip pan comprising an outlet to drain and recirculate excess liquid coating material that flows from the ends of said metering roller, said doctor assembly comprising means to hold said elongated blade and adjust the blade pressure against the metering roller, said liquid coating delivery means comprising a centrally positioned outlet to deliver coating recirculated from said drip pan.

6. The apparatus of claim 3 wherein said latch means comprises a lug mounted on said press unit positioned to cooperate with said cylinder, said cylinder being a hydraulic cylinder, said latch further comprising a quick-release interconnect between said lug and said cylinder.

7. The apparatus of claim 6 wherein said latch means comprises a pivoting member that pivots between a first position attached to said lug and a second position that releases said coater from said press unit.

8. The apparatus of claim 7 wherein said latch means comprises a hook member configured to pivotally engage said lug on said press unit.

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United States Patent [19]

Jahn

[11] **Patent Number:** **4,706,601**

[45] **Date of Patent:** **Nov. 17, 1987**

[54] **DEVICE FOR APPLYING MEDIUM AFTER TERMINATION OF THE PRINTING OPERATION IN A PRINTING MACHINE**

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[73] Assignee: **Heidelberger Druckmaschinen AG**, Heidelberg, Fed. Rep. of Germany

[21] Appl. No.: **735,954**

[22] Filed: **May 20, 1985**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 626,732, Jul. 2, 1984, abandoned.

[30] **Foreign Application Priority Data**

Jul. 5, 1983 [DE] Fed. Rep. of Germany 3324096

[51] **Int. Cl.**[4] **B05C 1/02; B05C 11/10**

[52] **U.S. Cl.** **118/46;** 118/211; 118/236; 118/249; 118/262

[58] **Field of Search** 118/46, 236, 249, 104, 118/203, 211, 247, 262

[56] **References Cited**

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Primary Examiner—Evan K. Lawrence

Attorney, Agent, or Firm—Herbert L. Lerner; Laurence A. Greenberg

[57] **ABSTRACT**

In a printing machine, a medium applicator disposed downstream of printing units of the machine, in travel direction of a sheet which has been printed, the applicator having three rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium, includes a rubber lining disposed on the third roller for directly applying the medium onto the printed sheet; the three rollers, during application of the medium, being in constant meshing engagement with a sheet-transferring cylinder; a device for uncoupling the three rollers from the sheet-transferring cylinder, and a separate motor for driving the three rollers when the rollers are uncoupled.

6 Claims, 6 Drawing Figures

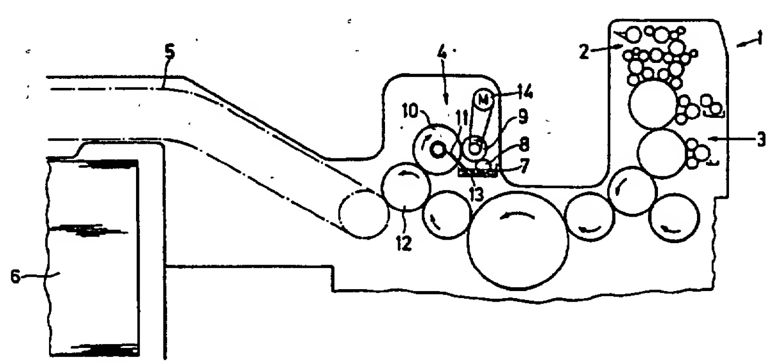


Fig. 1

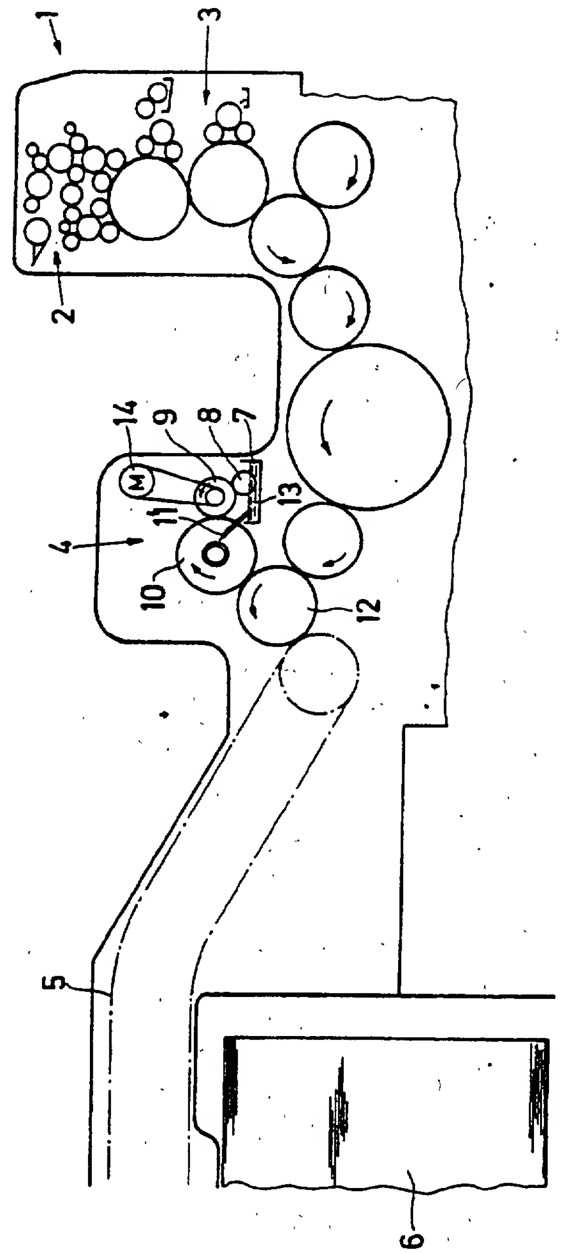


Fig. 2

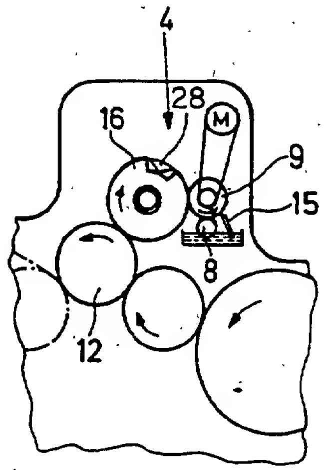


Fig. 3

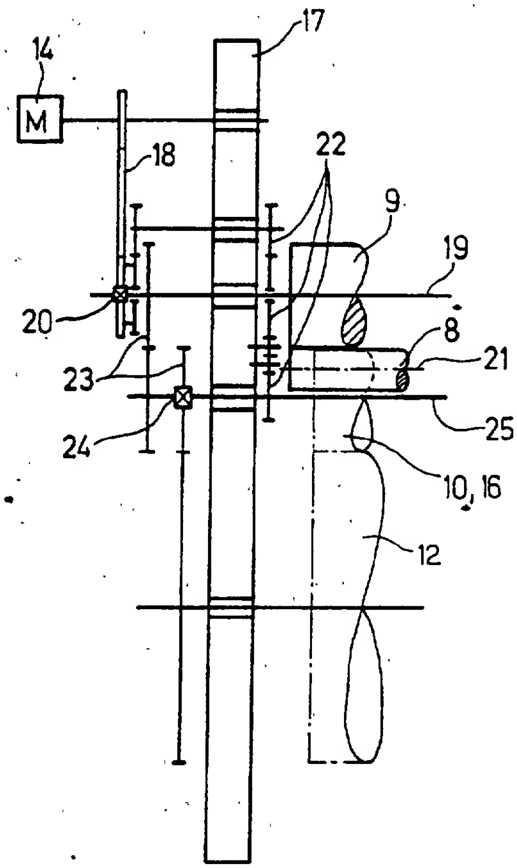


Fig. 4

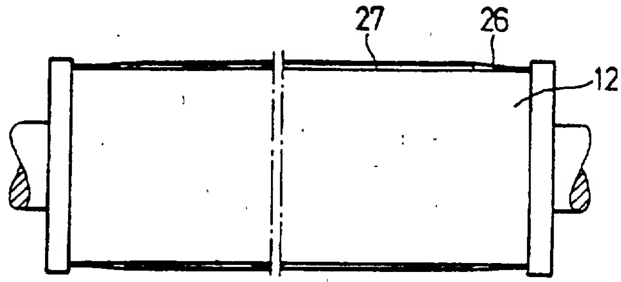


Fig. 5

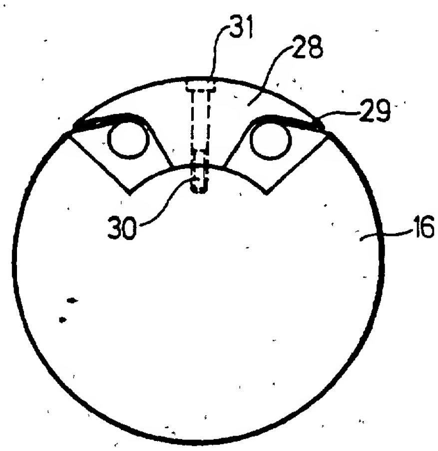
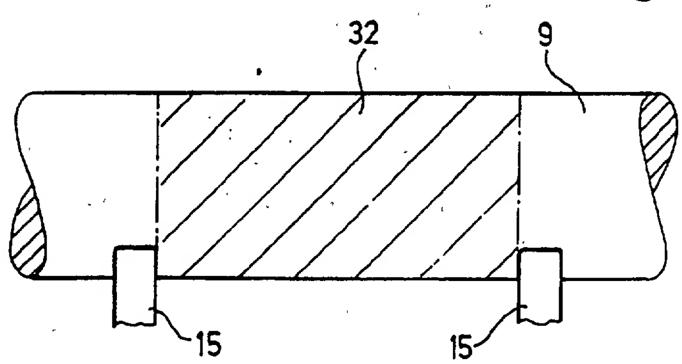


Fig. 6



DEVICE FOR APPLYING MEDIUM AFTER TERMINATION OF THE PRINTING OPERATION IN A PRINTING MACHINE

This is a continuation-in-part application of Ser. No. 626,732, filed July 2, 1984, and now abandoned.

The invention relates to a device in printing machines for applying a medium, such as lacquer, especially, by means of three rollers, after the printing process has been terminated, the rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium to a printed sheet.

A lacquering or varnishing device in printing machines has become known theretofore from German Published Non-Prosecuted Application No. (DE-OS) 30 46 257. This device includes a lacquer storage tank or supply container and a scooping roller dipping into this tank. The lacquer taken up by the scooping roller is fed in metered fashion to an applicator roller. Two ductor rollers, by means of which a format-related lacquer feed occurs, can be set close to the scooping roller. A ductor blade applicable against the metering roller is also provided. This ductor blade serves to wipe superfluous lacquer from the metering roller and to return it to the supply container.

A specific disadvantage of this heretofore known device is that the lacquer is fed to the varnishing or lacquering cylinder via a distributor roller and an applicator roller. Because of the relatively long transport distance which the lacquer has to cover over many rollers until it reaches the printed sheet, the lacquer begins to set i.e. no quick-drying lacquers can be used. Due to this limitation to slowly drying lacquers, when the sheet is delivered the reverse side or back of the next following sheet will smear the lacquer and thus paste the sheets together. Consequently, no full sheet piles can be set up, because the pile weight which is built up at the delivery end and which applies a load to the individual sheets also limits the lacquer layer thickness.

In the device described in German Pat. No. 23 45 183 for applying a medium there are provided a dipping roller, a metering roller, an applicator roller, a back-pressure cylinder, a form cylinder and another applicator roller. The two applicator rollers, the dipping roller and the metering roller are combined into a common structural unit. Within this structural unit, either the dipping roller with the form cylinder or the first applicator roller with the form cylinder or the second applicator roller with the back-pressure cylinder can cooperate.

A disadvantage of this last-mentioned construction is that the lacquer must first be fed to the printed material via the form cylinder. The platen mounted on the clamping device at the form cylinder forms a channel in which the lacquer accumulates after a given operating time. This lacquer-accumulation results in an irregular lacquer application due to dripping of the lacquer down onto the printed material.

German Pat. No. 20 20 584 is based upon a device for avoiding smearing of the ink due to lacquering. By means of a lacquering unit, the lacquer is applied to a printing- unit cylinder. This printing-unit cylinder, which has the same diameter as that of the cylinders of the preceding printing units, transfers the lacquer to the printed material. The disadvantages referred to hereinbefore are also applicable to this construction and require additionally, time-consuming cleaning work to be performed on the rollers. Moreover, the construction of the printing unit is complicated by having to attach the lacquering unit to the rubber of the blanket cylinder.

A further disadvantage of the state of art as exemplified by the references cited hereinbefore, is that, due to the directions of rotation of the rollers, the format-related wiping by the ductor blade cannot be observed, thus making impossible a precise wiping or removal of the superfluous lacquer material.

It is, accordingly, an object of the invention to provide a device for applying a medium such as lacquering unit in a printing machine, wherein the medium, such as lacquer, has to travel over the shortest possible distance from the storage tank or supply container to the printed material, and wherein drying of the lacquer on the rollers is prevented, when the lacquering unit is connectible and disconnectible, as required.

With the foregoing and other objects in view, there is provided, in accordance with the invention, in a printing machine, a medium applicator disposed downstream of printing units of the machine in the travel direction of a sheet which has been printed, the applicator having three rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium comprising a rubber lining disposed on the third roller for directly applying the medium onto the printed sheet; the three rollers, during application of the medium being in constant meshing engagement with a sheet-transferring cylinder; means for uncoupling the three rollers from the sheet-transferring cylinder, and separate motor means for driving the three rollers when the rollers are uncoupled.

In accordance with another feature of the invention, the third roller is in the form of a cylinder with a continuous surface.

Due to the fact that the cylinder surface of the applicator roller is not broken by a channel, the lacquer can be applied uniformly. Thus, the burdensome cleaning operations can be dispensed with. Because of the limitation to this relatively small number of rollers, it is possible, for example, to apply the lacquer directly to the sheet after the last ink impression i.e. to bring it on-line. When, for example, printed cardboard, which is to be converted afterwards into packaging material, is provided with such a lacquer layer, then this packaging material receives increased portection thereby which is of advantage during the subsequent transport operation. Moreover, the gloss provided by the lacquer enhances the effect of the impression. The cardboard or pastboard treated in this way is also better protected against environmental influence.

Because the rollers, during the application of the medium are in constant meshing contact with the cylinder, assurance is provided that the subsequent or further treatment of the surfaces of the printed material occurs at the speed of the printing machine.

Disengagement of the lacquering device from the cylinder provides the possibility of excluding a given portion of the impression from any subsequent treatment. The motor provided for driving the rollers of the applicator of lacquering prevents drying of the medium

on the rollers. Thus, the burdensome cleaning activities can be dispensed with for the next operating cycle.

In accordance with a further feature of the invention, the rubber lining on the third roller is a rubber cloth applied in an abuttting manner, the third roller having the same diameter as that of the sheet-transferring cylinder; and the third roller being connected by a single-revolution clutch to the sheet-transferring cylinder.

It is thereby possible to use any type of cylinders, because, in this form of application of the rubber cloth or blanket also, no channel is formed in which the lacquer might otherwise accumulate. The third roller has the same diameter as a printing-unit cylinder.

In accordance with an added feature of the invention, there is provided a ductor blade disposed on at least one of the end faces of the third roller serving to transfer the medium to the printed sheet, the ductor blade being disposed so that when superfluous medium is removed by the ductor blade, the thus removed superfluous medum can flow back into the supply container. Thus, an economical use of the medium, in the further treatment is afforded thereby, and contamination of the printing machine is prevented.

In accordance with an additional feature of the invention, the third roller is in the form of a cylinder having a channel formed therein; and including an insert member received in channel so as to complete a continuous cylinder. By inserting a filling piece or insert member into this channel, which can be covered by a rubber cloth or blanket, the benefits of a full or solid cylinder can also be attained.

When such cylinders are used, in accordance with a concomitant feature of the invention, a ductor blade is disposed on the second roller. Thus, precise metering of the medium or lacquer occurs in conformity with the sheet format. A particularly advantageous metering process is also ensured due to the directions of rotation of the rollers, because, in this arrangement, the applcation of the lacquer is always effected from above.

Other features which are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as embodied in a device for applying medium after termination of the printing operation in a printing machine, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therien without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a diagrammatic elevational view of a printing machine with lacquering unit and a ductor blade assembly arranged at an applicator roller and disposed in front of the delivery unit; and

FIG. 2 is a fragmentary view of FIG. 1 showing the printing machine with lacquering unit and with a ductor blade arranged at a metering roller.

FIG. 3 is a diagrammatic side elevational view of the gearing and uncoupling mechanism for the rollers of the lacquering unit;

FIG. 4 is a diagrammatic axial view of a sheet transferring cylinder of the lacquering unit equipped with a format-related underlay;

FIG. 5 is an end view of one of the rollers of the laquering unit which is formed with a longitudinal channel wherein an insert member is received; and

FIG. 6 is a diagrammatic longitudinal view of the metering roller of the lacquering unit and showing ductor blades disposed thereon.

Referring now to the drawing and first, particularly, to FIG. 1 thereof, there is shown a printing machine with a final last printing unit 1 equipped with a conventional inking unit 2 and a conventional dampening unit 3. This last printing unit 1 is followed by a lacquering unit 4. The printed sheets are fed by the last printing unit 1 to the lacquering unit 4. Subsequent to a final treatment of the sheets by the lacquering unit 4, the sheets are seized by a delivery chain 5 and thus transported to a delivery pile 6.

The lacquering unit 4 which is arranged downstream of or behind the last printing unit 1 in travel direction of the sheets is formed of a dipping roller 8 revolving within a supply container or tank 7, a metering roller 9 and an applicator roller 10 provided with a rubber lining or covering (not shown). At an end face of this applicator roller 10, there is additionally a ductor blade 11. The specific character of the applicator roller 10, which has the same diameter as that of a sheet transferring cylinder 12, is maintained both when it is covered with a separate rubber cloth or blanket and the channel formed therein covered by an insert member or a filling or loading piece, or, alternatively, when a rubber cloth of blanket is applied so that the leading and trailing edges thereof abut. Consequently, it is also possible to limit the applicaton of the lacquer to specific areas. The applicator roller 10 is in direct contact with the cylinder 12 which is provided with an elevator mechanism adapted to the sheet format and on which the printed sheet which is to be further processed is located. This cylinder 12 is equipped with non-illustrated grippers disposed in recesses i.e. the gripper back is at a deeper level than the surface of the sheet which is to be further processed. After the further processing has been completed, the cylinder 12 transfers the sheet to the conveyor or delivery chain 5 of the delivery unit which conveys the sheet to the deliver pile 6.

The storage tank or supply container 7 contains a medium or agent 13 to be used for the further treatment or processing of the printed sheets. This medium may be either a lacquer or a rubber cement or any other agent suited for this purpose. During the rotating movement of the dipping roller 8, the medium 13 is taken up thereby and subsequently transferred to the metering roller 9. The applicator roller 10 which is in direct contact with the metering roller 9 transfers the medium 13 to the surface of the printed sheet which is to be treated.

Because it is hardly possible to prevent the medium 13 from running down over the ends of the applicator roller 10, ductor blades 11 are disposed thereat. The medium 13 running down the ends of the applicator roller 10 is wiped off by the ductor blade 11 and flows back to the storage tank or supply container 7 for reuse. In this way, contamination of the printing machine is prevented and, at the same time, economical use of the medium 13 is enhanced.

The applicator roller 10 is controllable via an impression throw-off which is applied in such a manner that only the applicator roller 10 can be engageable with and retracted from the cylinder 12. Hence, the dipping roller 8, the metering roller 9 and the applicator roller 10

are always in mutual contact. During the application of the medium 13, the rollers 8, 9 and 10 of the lacquering unit 4 are driven via the drive mechanism of the printing machine. The further treatment or processing of the sheets thus occurs, at the operating and printing speed, respectively, of the machine.

When this further or subsequent treatment of the sheets is, for example, not required for a specific portion of the total impression or when the printing machine is stopped for a time, then the lacquering appliance 4 is disengaged from the cylinder 12. In order to prevent the medium 13 from drying on the rollers 8, 9 and 10 during this period of time, a motor 14 which is coupled to the metering roller 9 takes up the driving function and, thus, indirectly also the driving of the dripping roller 8 and of the applicator roller 10 which are in direct contact with the metering roller 9. In this regard the rollers 8, 9 and 10 need not rotate at fully machine speed. Only a few rotations per minute are thus required in order to prevent the drying of the medium 13.

A single-revolution coupling or clutch 24 (FIG. 3), for example, effects the disengagement or decoupling of the lacquering unit 4 from the cyliner 12 when the specific embodiment is one wherein the rubber cloth or blanket has been applied in an abutting manner on the applicator roller.

Another embodiment of the lacquering unit 4 is illustrated in FIG. 2. The dipping roller 8 revolves in the storage tank or supply container 7 filed up with the medium 13, takes up the medium and transfers it to the metering roller 9. A ductor blade 15 is disposed on this metering roller 9 for effecting metered transfer of the medium 13. This metering feature operating in correspondence with a particular format permits the use also of a cylinder 16 interrupted or broken by a channel as an applicator roller. This cylinder 16 is also in direct contact with the sheet-carrying cylinder 12. For effecting disengagement, a single-revolution clutch or coupling 24 (FIG. 3) is used in order that, when the lacquering unit is restarted, the cylinder 16 does not touch down on the sheet at the very place where the channel is located. The drive of the lacquering unit 4 is effected in the same manner as for that of the lacquering unit 4 illustrated in FIG. 1.

The embodiments of this lacquering unit 4 permit the use thereof at all times as another printing unit. Because the applicator roller 10 or the cyliner 16 are rollers covered with a rubber lining or blanket, the possibility is afforded of having an additional impression cylinder and inking unit available, without great expense.

The uncouplability of the three rollers is represented in FIG. 3. The motor 14 is mounted in the side wall 17 located at the drive side of the printing machine, and drives a shaft 19 of the metering roller 9 via a belt 18 and a free-wheeling coupling 20. A shaft 21 of the dipping roller 8 is connected to the shaft 19 via gears 22. Likewise, a shaft 25 of the applicator roller 10 and of the cylinder 16, respectively, is coupled with the shaft 19 of the metering roller 9 via gears 23 and the single-revolution coupling or clutch 24.

The format-related underlay is shown in FIG. 4. Before a rubber blanket 26 is tightened on and around the cylinder 12, a previously calibrated sheet 27 accurately cut to the format being used is laid under. Assurance is thereby afforded that the application of lacquer will occur only in this region.

In FIG. 5, an insert member or filling or loading piece 28 is shown received in a channel 29 formed in the cylinder 16. The insert member 28 which is accommodated to the diameter of the cylinder 16 is fastened in the cylinder channel 29 to the cylinder 16 by a spindle 30 and a screw 31.

As shown in FIG. 6, a lacquer layer 32 applied by the dipping roller 8 to the metering roller 9 is suitably doctored by the displaceably arranged doctor blade 15 in a manner related to the format of the sheet which is to be printed.

There is claimed:

1. In a printing machine, a medium applicator disposed downstream of printing units of the machine in the travel direction of a sheet which has been printed, the applicator having three rollers including a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller having the same diameter as that of cylinders of the printing units for transferring the medium, comprising a rubber lining disposed on the third roller for directly applying the medium onto the printed sheet; the three rollers, during application of the medium, being in constant meshing engagement with a sheet-transferring cylinder; means for uncoupling the three rollers from the sheet-transferring cylinder, and separate motor means for driving the three rollers when said rollers are uncoupled.

2. Medium applicator according to claim 1, wherein the third roller is in the form of a cylinder with a continuous surface.

3. Medium applicator according to claim 2 wherein the rubber lining is a rubber cloth applied in abutting manner on the third roller, the third roller having the same diameter as that of the sheet-transferring cylinder, and the third roller being connected by a single-revolution clutch to said sheet-transferring cylinder.

4. Medium applicator according to claim 1, including a ductor blade disposed on at least one of the end faces of the third roller serving to transfer the medium to the printed sheet, said ductor blade being disposed so that when superfluous medium is removed by the ductor blade, the thus removed superfluous medium can flow back into the supply container.

5. Medium applicator according to claim 1, wherein the third roller is in the form of a cylinder having a channel formed therein; and including an insert member received in said channel so as to complete a continuous cylinder.

6. Medium applicator according to claim 1 including a ductor blade disposed on the second roller for ensuring exact format-related metering of the medium.

* * * * *

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United States Patent [19]

Frazzitta

[11] **Patent Number:** 4,779,557

[45] **Date of Patent:** Oct. 25, 1988

[54] **COATER FOR A SHEET FED PRINTING PRESS**

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[21] Appl. No.: 77,699

[22] Filed: Jul. 27, 1987

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 902,782, Dec. 4, 1986, abandoned, which is a continuation of Ser. No. 748,974, Jun. 26, 1985, abandoned.

[51] Int. Cl.[4] B05C 1/02

[52] U.S. Cl. 118/46; 118/224; 118/249; 118/262

[58] Field of Search 118/46, 224, 249, 262; 101/419; 427/428

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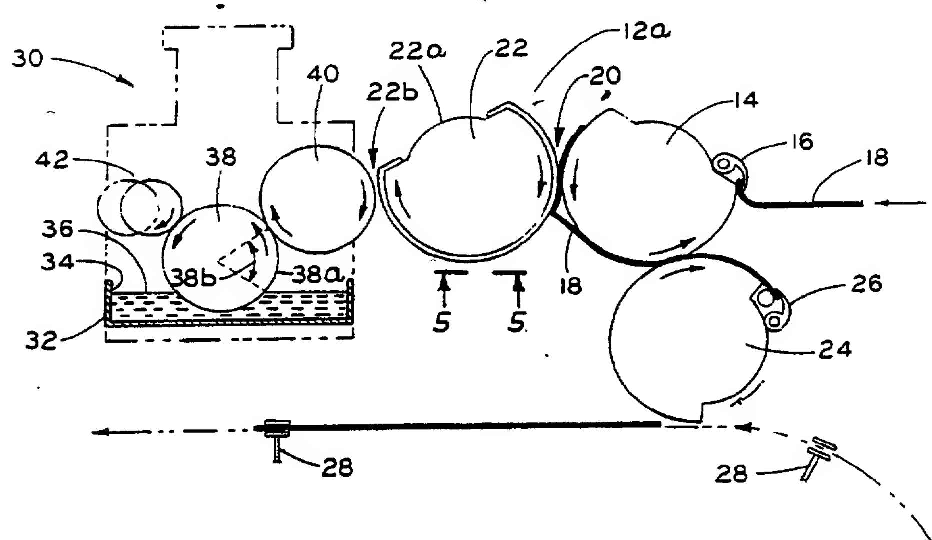
Primary Examiner—Evan K. Lawrence

[57] **ABSTRACT**

A coater for an offset printing press in which the last printing station, i.e., the blanket cylinder roller with its associated sheet-handling grippers, is converted to coating service, such that a pick-up roller, after an ascending arcuate path not exceeding 80°, transfers a liquid coating to an applicator roller rotating in an opposing direction to the blanket cylinder surface which coats the individual imprinted sheets and the liquid coating itself serves as a lubricant permitting said opposing directions of rotation and grippers of said blanket cylinder roller maintain proper handling control of the sheets during the coating thereof. Limiting the arcuate path of 80° obviates reverse flow of the liquid coating on the pick-up roller.

4 Claims, 3 Drawing Sheets



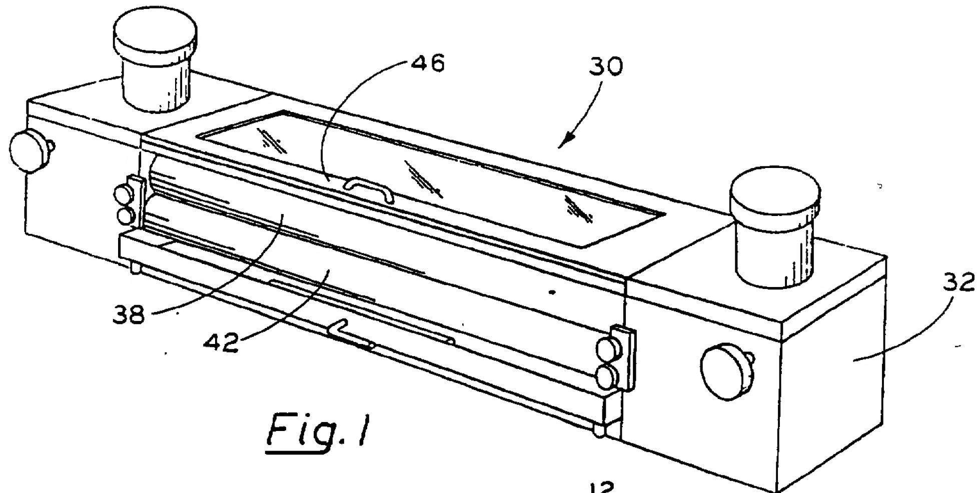


Fig. 1

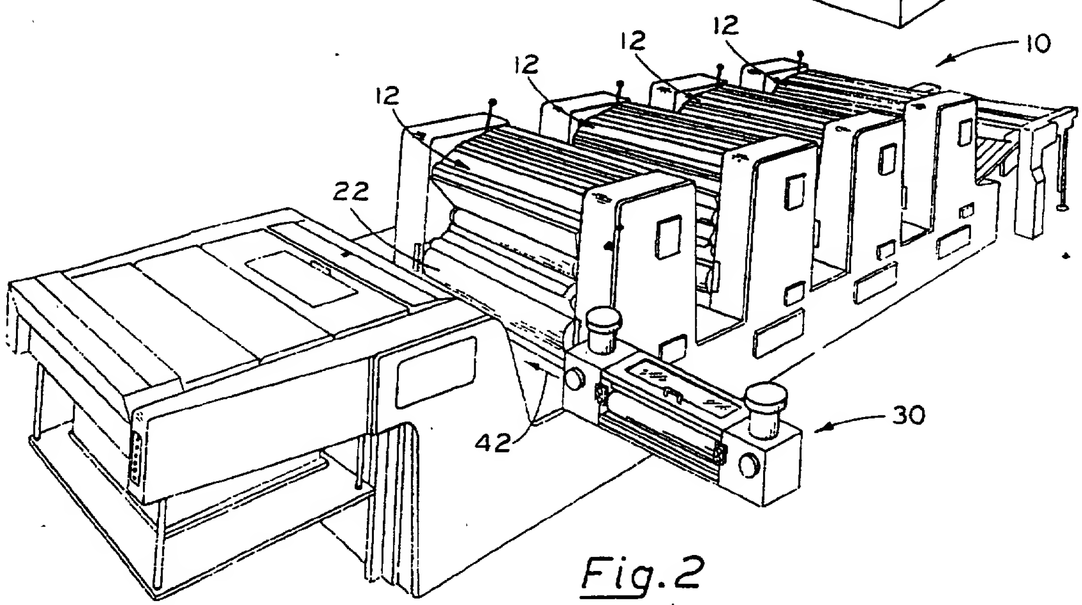


Fig. 2

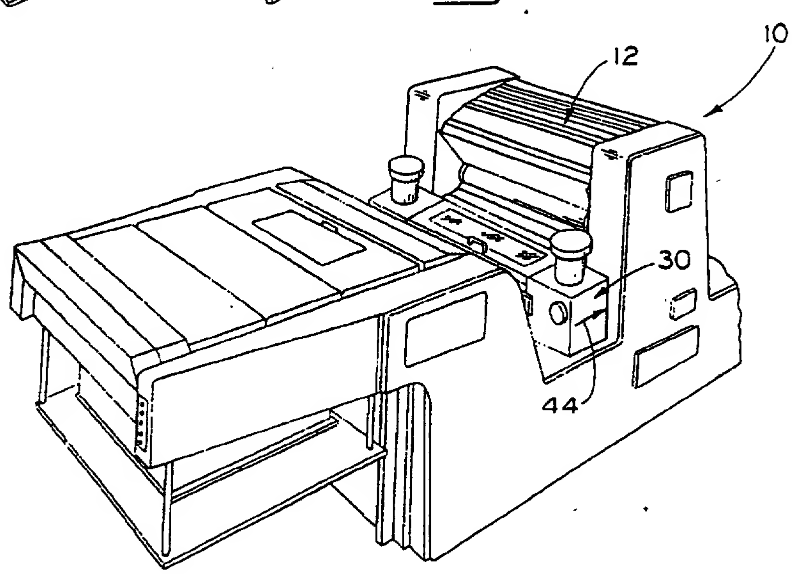


Fig. 3

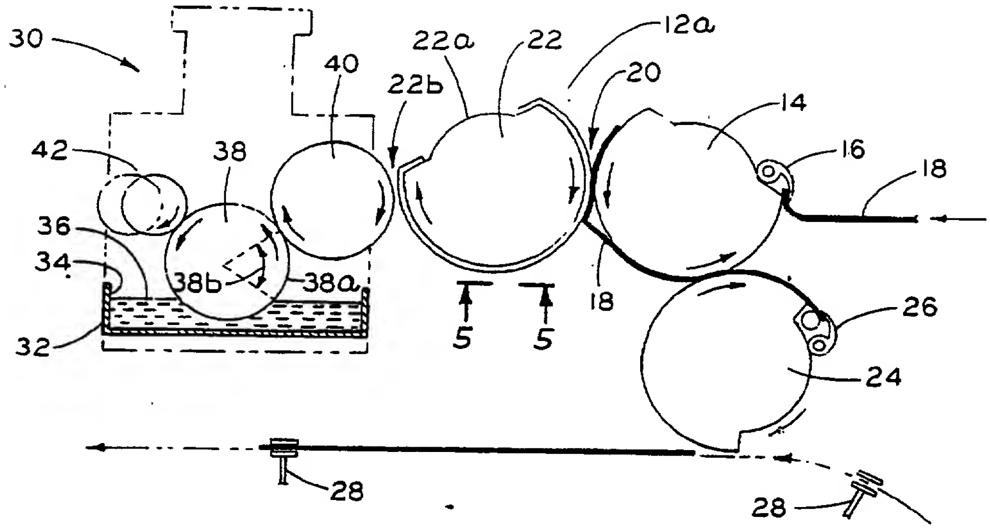


Fig. 4

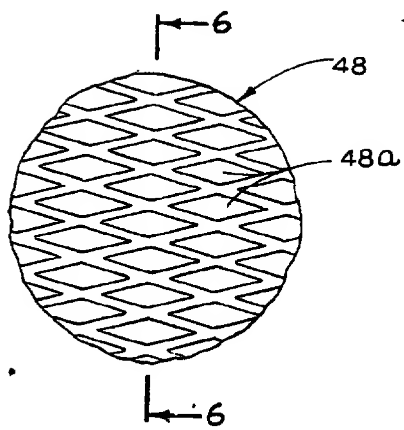


Fig. 5

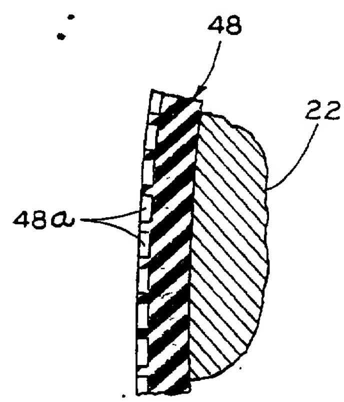


Fig. 6

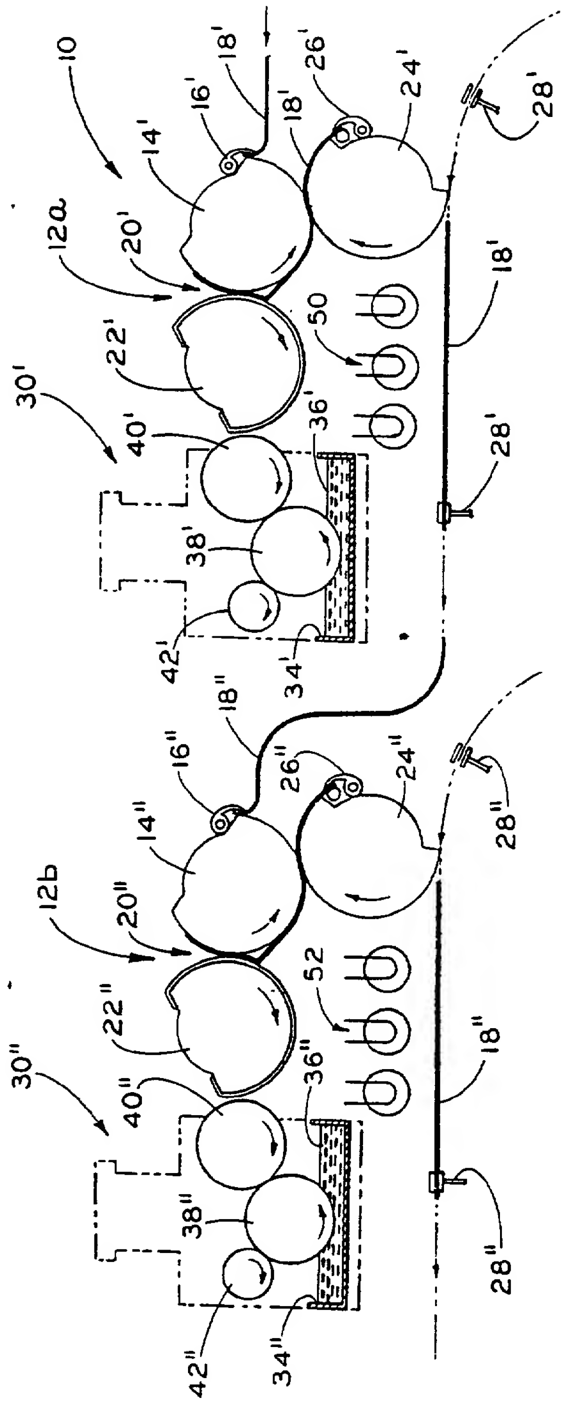

10
12a
14'
16'
18'
18'
18'
20'
22'
24'
26'
28'
28'
30'
34'
36'
38'
40'
42'
50
12b
14"
16"
18"
18"
20"
22"
24"
26"
28"
28"
30"
34"
36"
38"
40"
42"
52

Fig. 7

COATER FOR A SHEET FED PRINTING PRESS

This is a continuation-in-part of application Ser. No. 902,782, filed Dec. 4, 1986, now abandoned, which is a continuation of application Ser. No. 748,974, filed June 26, 1985, now abandoned.

The present invention relates to improvements in coating individual sheets during the printing thereof in an offset printing press, and more particularly to a coating device for an offset printing press that effectively applies a aqueous, ultra-violet or other liquid coating to each imprinted sheet, in turn, without adversely affecting the printing operation of the printing press.

Applying liquid coating to printed material is, of course, already well known, and achieved using coating devices of well-known construction and modes of operation, as exemplified by the coating devices of U.S. Pat. Nos. 3,257,226, 3,029,780, and 3,951,102. These known coaters however are not noteworthy in their effectiveness and, most important, are not compatible with the operation of a standard offset printing press, to which the within invention is applied, as distinguished from a so-called web press. That is, the known coaters are restricted to use with said web press in which a continuous web is fed through the press and a significant degree of tension can therefore be exerted on the web as it is being printed. This ability to apply tension to a continuous web greatly facilitates the application of a coating thereto, whereas applying the same degree of tension to individually fed sheets of an offset printing press, an operating parameter which usually is required during the coating of the individul sheets, may inadvertently cause disengagement of the individual sheet from the grippers and thus seriously adversely affect the printing operation of the standard offset printing press.

Broadly, it is an object of the present invention to provide a coater for an offset printing press handling individually fed sheets overcoming the foregoing and other shortcomings of the prior art. More particularly, it is an object to utilize to advantage the sheet-handling apparatus of the printing press and to combine therewith a surface coating means, so that coating is effectively applied to the imprinted sheets while they are under the handling control of the printing press.

A coater demonstrating objects and advantages of the present invention is applied to a printing press of the type in which individual sheets are imprinted during passage through a nip between a cooperating blanket cylinder roller and an impression cylinder, said nip defining each of plural printing stations operatively arranged in series relation with each other. More particularly, the coater includes an operational mode that contemplates using the last encountered blanket cylinder roller for coating service, rather than printing, and operatively arranging same for counterclockwise direction rotation. Located adjacent the blanket cylinder roller is a storage container for a supply of a liquid coating to be applied to the individually printed sheets having a pick-up roller disposed with a lower portion in the liquid coating supply and operatively arranged for counterclockwise rotation for moving the liquid coating adhered to the surface thereof through an ascending arcuate path of less than 180 degrees, this restricted path being effective to obviate reverse direction flow of said liquid coating along said pick-up roller surface. Completing the rotating components is an applicator roller operatively arranged in contact with the pick-up roller

along said arcuate path and also in contact with the blanket cylinder roller, said applicator roller being operatively arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from the counterclockwise rotating pick-up roller at the respective surfaces of each which are either in light surface contact with each other or slightly spaced apart. In this way the imprinted sheets are individually coated during passage between the opposite direction rotating applicator and blanket cylinder rollers, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of presently preferred, but nonetheless illustrative embodiments in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a coating device which, in accordance with present invention, is used in cooperating conjunction with a blanket cylinder roller of a standard offset printing press;

FIG. 2 is also a perspective view and illustrates how the coating device of FIG. 1 is moved into its operative position with the blanket cylinder roller of said printing press;

FIG. 3 is a partial perspective view illustrating the operative position of said coating device at a printing station of said printing press;

FIG. 4 is a simplified side elevational view in longitudinal cross section illustrating structural details of the printing press and coating-applying cooperating rollers of the within invention;

FIG. 5 is a partial view as seen along lines 5—5 of FIG. 4 illustrating, on an enlarged scale, structural details of an elastomeric blanket of the blanket cylinder roller;

FIG. 6 is a view in cross section, taken along lines 6—6 of FIG. 5, showing further structural details of the surface of said blanket cylinder roller; and

FIG. 7 is a view similar to FIG. 4, but illustrating the application of two coatings to the sheet fed material at two printing stations.

Illustrated in FIG. 2 and partially in FIG. 3, will be understood to be a standard sheet fed offset printing press, generally designated 10. As is well understood, said standard offset printing press 10 includes plural printing stations, individually and collectively designated 12, at which a separate color is transferred to individual sheets providing a multi-color result. More particularly, and as will be explained in greater detail subsequently, on multi-color presses of which the printing press 10 will be understood to be an example, the transferring of a sheet from one printing station 12 to the next printing station located in line therewith, while keeping said sheet in exact register, is accomplished by means of transfer cylinders whose grippers are timed to take hold of the sheet before they are released by the previous cylinder gripper. For purposes of the within invention, it is important to note that the aforesaid operation of a standard offset printing press differs significantly from a so-called web press, in which a continuous web is fed through the press and a significant degree of tension can therefore be exerted on the web as it is being printed. This ability to apply tension to a continuous web greatly facilitates the application of a coating

thereto, whereas applying the same degree of tension to individually fed sheets of an offset printing press, an operating parameter which usually is required during the coating on the individual sheets, may inadvertently cause disengagement of the individual sheet from the grippers and thus seriously adversely affect the printing operation of the standard offset printing press.

An important contribution of the present invention therefore is the achievement of applying a coating to individually fed sheets of a standard offset printing press, such as press 10, without adversely affecting the printing operation of said press

The manner in which, in accordance with the present invention, individual fed sheets of an offset printing press are effectively coated, can best be appreciated by the simplified cross sectional view of FIG. 4, to which figure reference should now be made. In accordance with the present invention, the last encountered printing station 12, designated 12a in FIG. 4, is incorporated as part of the within inventive coating operation. Printing station 12a, as is well understood, is defined by an impression cylinder 14 having standard cnstructed and operating grippers 16 which effectively grip, in turn, the leading edge of each imprinted sheet 18. Rotation of the impression cylinder 14 carries the gripped sheet 18 to the nip 20 of said impression cylinder 14 and a cooperating blanket cylinder 22. When used for printing, the blanket cylinder 22 prior to the nip 20 receives an ink image from a printing plate (not shown) and effectively transfers this ink image to the sheet 18. In accordance with the present invention, however, the blanket cylinder 22 is not used for printing service, but is used for effectively applying a liquid coating to the individually fed sheets 18, said coating typically being an appropriate chemical for blocking adverse effects of ultra-violet rays or other aqueous coating, or may even be an acrylic water based coating to provide a gloss or otherwise enhance the appearance of the imprinted sheet. The coating may also accelerate the drying of the printing ink applied to the sheet.

Before describing how the liquid coating is applied, it is helpful to complete the description of the operation of the components of the printing press at station 12a. This operation is completed by a transfer cylinder 24 having grippers 26 which in a well understood manner engage the sheet 18 as it exits from the nip 20 and effectively transfers each sheet 18 to sheet-gripping devices 28 of a conveyor which delivers each sheet to a point of discharge.

Thus far what has been described, except for the use at station 12a of the blanket cylinder 22 for coating rather than printing service, is well understood and does not form an essential part of the within invention. The contribution of the within invention, which will now be described, consists of the coating device, shown in isolated perspective in FIG. 1 and generally designated 30 therein, which cooperates with and has an operative position in relation to the blanket cylinder 22, as shown in FIGS. 2, 3, and as now will be described in detail.

Still referring to FIG. 4, the coating device 30 includes a housing 32 which bounds a compartment 34 for the storage of a supply of the liquid coating 36 to be applied to the individual fed sheets 18. Appropriately journaled for rotation in the lower portion of the supply 36 is a pickup roller 38, which, because the blanket cylinder roller 22 is journaled for rotation in a clockwise direction, is itself journaled for rotation in a counterclockwise direction, the reasons for which different directions of rotation will soon be apparent. During counterclockwise rotation of the pickup roller 38, however, a liquid coating which adheres to its surface is raised through an ascending path 38a and is transferred therefrom before the path 38a is as long as 180 degrees. As a result, a liquid which is picked up on the surface of the pickup roller 38 does not travel through an arcuate path of such length that there is reverse flow (i.e., flow in a direction which is opposite the rotational direction of roller 38) in the picked-up liquid coating. Rather, at a point of ascending movement which does not exceed to only 80 degrees as noted by the angle 38b, surface contact is established with said pickup roller 38 by an applicator roller 40 appropriately journaled for rotation in a clockwise direction. Thus, at the surface contact established with the pickup roller 38, the clockwise rotation of applicator roller 40 is in a direction which most effectively transfers a maximum amount of liquid coating from said pickup roller 38 to its surface. On the side of the applicator roller 40 opposite from the pickup roller 38, the surface of the applicator roller is located in a range from being in light contact with the surface of the blanket cylinder 22 to a slight gap 22b spaced therefrom. This light contact or slightly spaced apart relationship of the surfaces of the rollers 40 and 22 is necessitated by the opposing directions of rotation of these rollers. Nevertheless, it has been found in practice that the liquid coating, which may consist of the chemical sold under the trademark SUN CURE by General Printing Ink, division of Sun Chemical of New Jersey, effectively serves as a lubricant which permits the opposing directions of rotation while at the same time there is an effective transfer of the liquid coating from the surface of the applicator roller 40 the surface of the blanket cylinder 22 even, under some operating conditions, across the slight gap 22b. Naturally, there is no transfer in the gap area 22a of the blanket cylinder 22 which gap area must be provided in order to register with the gap area that has to be incorporated in the construction of the impression cylinder 14 because of the grippers 16.

Completing the construction of the coating device 30 is a metering roller 42 which in an appropriate manner is mounted for movement in a clearance position shown in phantom perspective in FIG. 4 into an operative condition shown in full line in FIG. 4, in which latter position it makes contact with the pickup roller 38. The metering roller 42 is only in contact with the pickup roller 38 when the apparatus is running in a standard mode, but said metering roller 42 is disengaged from the pickup roller 38 when the latter is running in a reverse mode (i.e., counterclockwise), thus giving the operator the option of running in either the standard or reverse mode.

Referring now to FIGS. 2 and 3, it is noted for completeness' sake that at the last encountered printing station, which, according to the present invention, is to be used for coating rather than printing service, there is exposure of and therefor ready access to the blanket cylinder 22 of this station. The coating device 30 will be understood to be on appropriate support apparatus, not shown, so that is can be effectively moved from a clearance position to the side of the printing press 10 as shown in FIG. 2, into an operative in line position in the direction 42, said operative position being more particularly illustrated in FIG. 3. In the operative position of FIG. 3 it will then be understood that preferably using pneumatic cylinders which engage the device 30 in its

operative position, that said device is effectively moved in the direction **44** towards the blanket cylinder **22** so that light contact or the slight gap **22b** is established with said blanket cylinder **22** and the previously referred to applicator roller **40** of the device **30**.

As is perhaps best illustrated in FIG. **1**, the coating device **30** includes, in addition to the components thereof previously described, a hinged top cover **46**, which when opened provides access for making any repairs or replacements to the pickup roller **38**, applicator roller **40** or metering roller **42**, as well as to the motor which is operatively associated with the metering roller **42** for moving it from its clearance position into contact with the pickup roller **38** and also for the motor which is operatively engaged to drive the pickup roller **38** through rotation. Access through the opening of the cover **46** to the compartment **34** is also necessary for replenishing the liquid coating supply **36**.

Special note is made in FIGS. **5** and **6** of a possible elastomeric blanket which is recommended for use for the blanket cylinder **22** to enhance its coating-applying efficiency. As shown in these figures, appropriately mounted about the periphery of the blanket cylinder **22** is an elastomeric blanket **48** having a pattern of surface depressions, individually and collectively designated **48a**, which are effective in receiving acrosss the nip or gap **22b** that previously was described as having been established between the applicator roller **40** and blanket **22**, a maximum amount of the liquid coating **36** for transfer to the individual fed sheets **18** at the nip **20**.

In the apparatus as illustrated and described in connection with FIGS. **2** and **3**, the direction of the individual fed sheets **18** are from right to left, and thus the rotation direction of the blanket cylinders **22**, including said cylinder at the coating station **12a**, are in a clockwise direction. It should be readily appreciated, however, that if the delivery of the individually fed sheets **18** were from left to right, that the rotation direction of the blanket cylinders would be in a counterclockwise direction, and that the rotation directions of the moving components of the coating device **30** would then be in the opposite direction than that illustrated and described in connection with FIG. **4**. Accordingly, it is to be understood that the within invention, and the claims defining same, contemplate both directions of rotation of the rotating components practicing said invention.

Referring now to FIG. **7**, it will be further understood that the within invention contemplates applying a coating to the individual fed sheets **18** at two stations, rather than just one station, as illustrated and described in connection with FIGS. **1–6**. A two-station coating process is particularly advantageous in order to achieve a high lamination appearance on the imprinted sheets **18**. That is, as understood, in order to presently achieve a high gloss on an imprinted sheet, it is necessary to use a mechanical process in which a plastic film is laminated to the printed substrate. In accordance with the present invention, it is now possible to achieve such a result chemically, rather than mechanically. To do this, and as illustrated diagramatically in FIG. **7**, the printing press **10** is modified to the extent of constructing an additional coating station **12b** down the line from station **12a** of FIG. **4**. In all other respects, except as noted, the structure already described in connection with FIG. **4** is the same, and this similarity is indicated in FIG. **7** by the use of the same reference numerals with a single prime of coating station **12a**, and a double prime at coating station **12b**. The only structure added to the setup of FIG. **7** are infrared lamp dryers **50** and **52** located as illustrated at the coating stations **12a** and **12b**, respectively. The dryers **50** and **52** will be understood to be of conventional construction and mode of operation and, in lieu thereof, good results can also be achieved using convection hot air units.

Coating station **12a** is preferred to coat the individual fed sheets **18** with an acrylic water base emulsion which is applied over the sheet **18** previously printed with an oil-based ink. Exposure of the sheet **18a** to the infrared lamp dryers **50** achieve surface drying thereof. Previously, the drying of the aqueous or ultraviolet coating on the sheet **18a** invariably resulted in a nominal gloss level in the printed sheet. As a result, it was standard practice to mechanically laminate a plastic film to the printed sheet to obtain a high gloss level in the surface thereof. In accordance with the system of FIG. **7**, however, the mechanical lamination is eliminated and in its place there is provided in accordance with the present invention a second coating station **12b** which preferably applies a high gloss photochemical epoxy resin coating to each individually fed sheet **18"** which is transferred from station **12a** to station **12b**.

From the foregoing description of the system of FIG. **7**, it should be readily appreciated that the process described and illustrated achieves a high gloss appearance in the imprinted sheets **12** that is the same as that achieved by mechanical lamination of plastic film and does so in much less time and without the equipment and apparatus necessary for a mechanical lamination process. The process of FIG. **7** utilizes already existing stations of a multi-station offset standard printing press modified in the manner herein illustrated and described to provide coating, rather printing service.

In the foregoing description, the reference to imprinted sheets and the application thereto of the within inventive coating methods is intended to have specific reference to chemically achieving an ultra high gloss surface over wet ink, an achievement which in the trade would be aptly called "wet trap in line", wherein the "wet trap" signifies achieving a dried ultra high gloss surface trapping wet inks on the paper substrate, and "in line" signifies achieving same during the normal offset printing process rather than, as now done in the prior art, mechanical bonding a plastic film to the printed sheet as a plastic film to the printed sheet as a separate operation.

However, the invention is not limited to a "wet trap in line process", and it is to be further understood that a latitude of modification, change and substitution is intended in the foregoing disclosure, and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claim be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A coater for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coater comprising said last encountered blanket cylinder roller used for coating service rather than printing operatively arranged for clockwise direction rotation, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid

coating supply operatively arranged for counterclockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being operatively arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from said counterclockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at said last encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

2. A coater for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of said plural printing stations operatively arranged in series relation with each other, said coater comprising said last encountered blanket cylinder roller used for coating service rather than printing operatively arranged for counterclockwise direction rotation, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for clockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being opratively arranged for counterclockwise rotation for maximizing the amount of liquid coating transferred thereto from said clockwise rotating pick-up roller at the respective surfaces of each in contact with each other, and effectively further transferring said liquid coating thereof to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at said last encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

3. A pair of coaters for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coaters comprising two sets of sequentially encountered blanket cylinder rollers used for coating service rather than printing operatively arranged for clockwise direction rotation, and for each said coater and its cooperating blanket cylinder roller, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for counterclockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending arcuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said pick-up roller along said arcuate path and also in contact with said baanket cylinder roller, said applicator roller being operatively.arranged for clockwise rotation for maximizing the amount of liquid coating transferred thereto from said counterclockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets at each said encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

4. A pair of coaters for a printing press of the type in which individual sheets are imprinted during passage between a cooperating blanket cylinder roller and an impression cylinder defining each of plural printing stations operatively arranged in series relation with each other, said coaters comprising two sets of sequentially encountered blanket cylinder rollers used for coating service rather than printing operatively arranged for counterclockwise direction rotation, and for each said coater and its cooperating blanket cylinder roller, a storage container for a supply of a liquid coating to be applied to said individually printed sheets, a pick-up roller having a lower portion disposed in said liquid coating supply operatively arranged for clockwise rotation for moving said liquid coating adhered to the surface thereof through an ascending aruuate path not exceeding 80 degrees to obviate reverse direction flow of said liquid coating along said pick-up roller surface, and an applicator roller operatively arranged in contact with said pick-up roller to receive said liquid coating thereon adjacent the end of said arcuate path not exceeding 80° and also either in contact with, or spaced by a slight gap from, said blanket cylinder roller, said applicator roller being operatively arranged for counterclockwise rotation for maximizing the amount of liquid coating transferred thereto from said clockwise rotating pick-up roller at the respective surfaces of each in contact with each other and effectively further transferring said liquid coating thereon to said opposing direction moving surface of said blanket cylinder roller operatively arranged at a clearance position therefrom preparatory to said liquid coating being applied to said imprinted sheets to each said encountered printing station, said liquid coating serving as a lubricant permitting said opposing direction movements in said applicator and blanket cylinder rollers.

* * * * *

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United States Patent [19]

Sarazen

[11] **Patent Number:** **4,796,528**

[45] **Date of Patent:** **Jan. 10, 1989**

[54] **SEPARATED INK FOUNTAIN FOR A FLEXOGRAPHIC PRINTING MACHINE**

[75] Inventor: **David J. Sarazen**, Hoboken, N.J.

[73] Assignee: **M.A.N. Roland Druckmaschinen AG**, Offenbach am Main, Fed. Rep. of Germany

[21] Appl. No.: **56,785**

[22] Filed: **May 29, 1987**

[51] **Int. Cl.**⁴ **B41F 31/06**
[52] **U.S. Cl.** **101/208**; 101/211
[58] **Field of Search** 101/207, 208, 209, 210, 101/350, 364, 363

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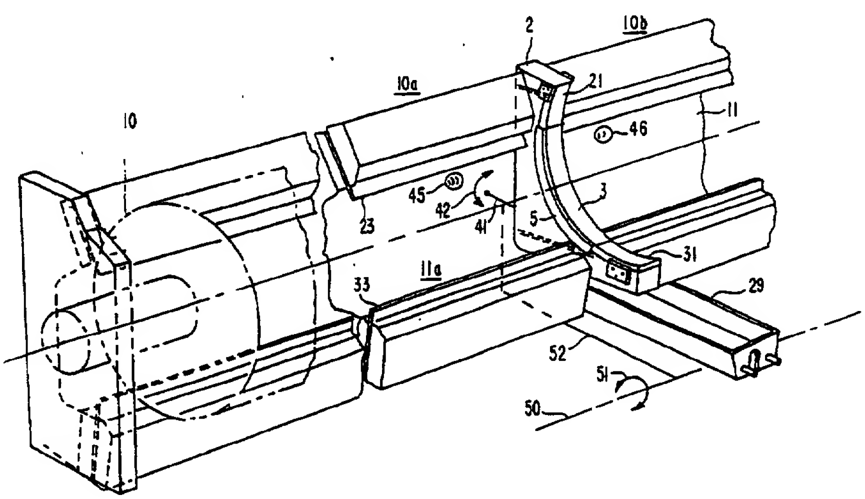
Primary Examiner—J. Reed Fisher
Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] **ABSTRACT**

To separate a flexographic ink fountain into axial zones (10*a*, 10*b* . . .) to permit use of inks of different characteristics, for example different colors along axial zones of an anilox roller (10), a separator element (2) has an insert strip element (3) extending over a portion of the circumference of the anilox roller, and resiliently engaged thereagainst, for example by compressed silicone rubber (5). Adjacent the end of the strip element (5) are two felt pads (21, 31) which are supplied from a source of separating fluids, such as water, alcohol-water solution or the like, to apply a ring-shaped film of the separating liquid on the anilox roller which film will continue beneath the separating strip (3), the separating strip being engaged against the roller with sufficient pressure to permit the strip to ride on the liquid film, similar to planing of autombile tires on a wet road surface. Two doctor blades are located on a trough structure, selectively moveable away from engagement with the surface of the anilox roller in dependence on rotation of the anilox roller. Additionally, the doctor blades (23, 33) can both be spaced from the surface of the anilox roller by a distance just sufficient to clear the anilox roller (10) thus permitting continued operation of the anilox roller when not in use under idling speed conditions, and preventing drying of ink on the anilox roller. When the doctor blades are removed from the anilox roller, the compressible material, and expansion of the felt pad retains the separating film of liquid on the anilox roller, thus saving "wash up" between extended periods when the machine is not printing while conserving the surface of the anilox roller and the edges of the doctor blades.

19 Claims, 2 Drawing Sheets



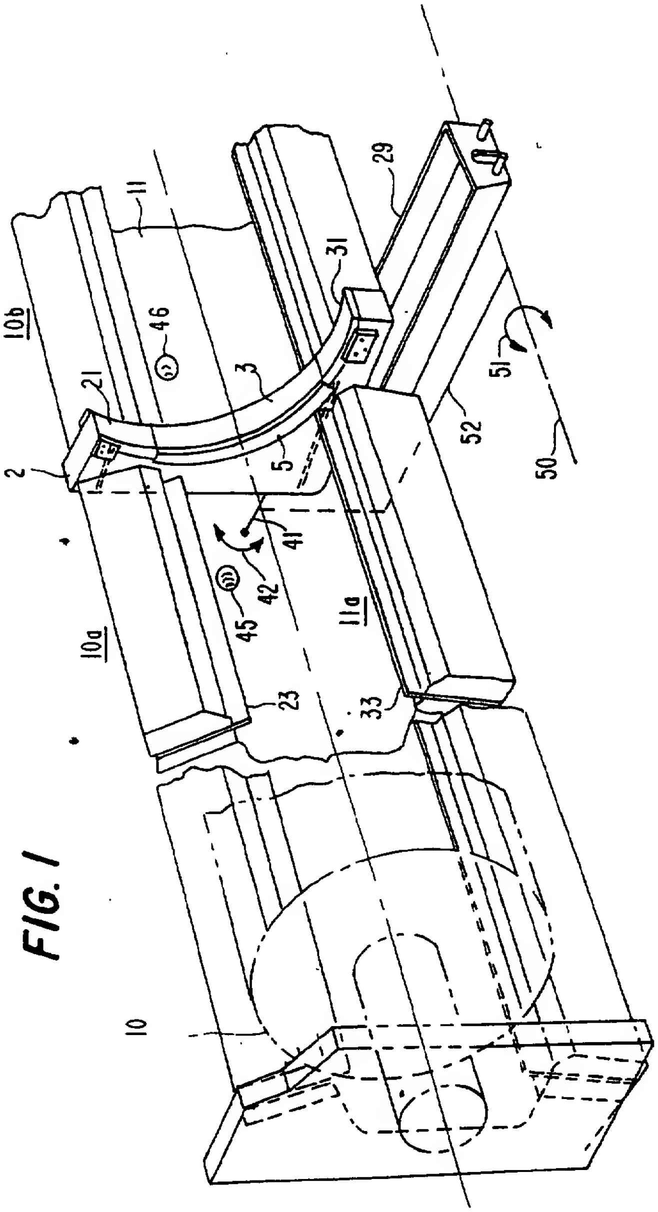
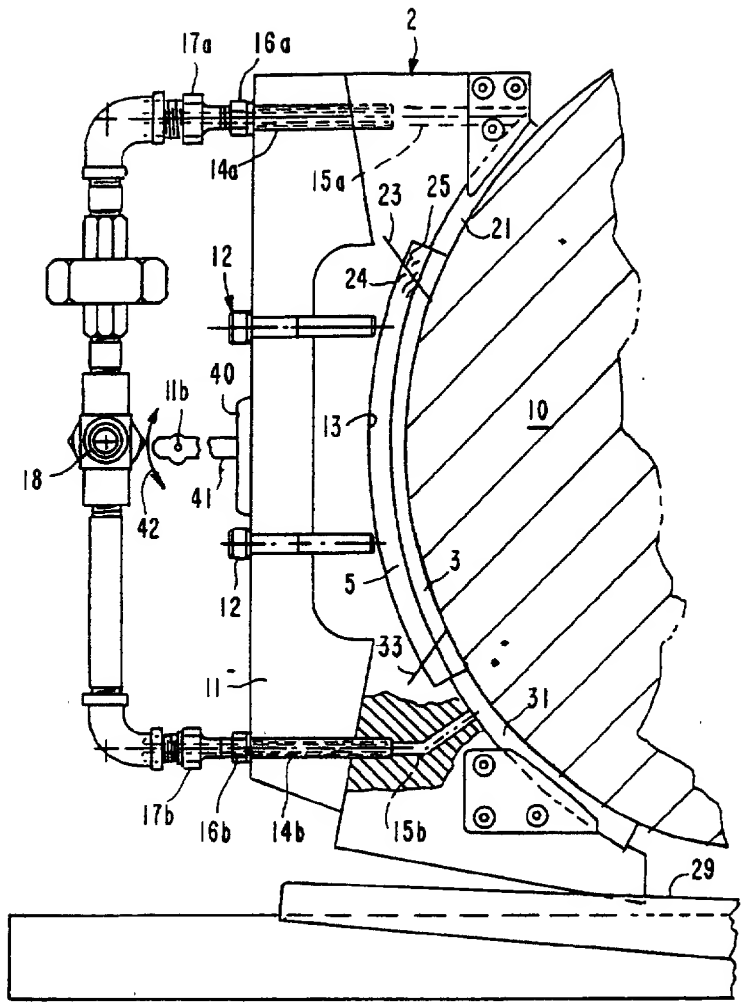


FIG. 1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17a
16a
14a
15a
23
25
21
24
12
40
11b
13
10
18
41
42
12
5
3
33
11
31
17b
16b
14b
15b
29

FIG. 2

SEPARATED INK FOUNTAIN FOR A FLEXOGRAPHIC PRINTING MACHINE

The present invention relates to printing machines and more particularly to flexographic printing machines, and especially to an ink system or ink fountain therefore, in which the ink fountain is subdivided into axially different zones to permit application of inks of different colors in the respective zones to corresponding zones on an application, or anilox roller.

BACKGROUND

Flexographic printing machines are increasingly used in the printing field. Usually, flexographic printing machines were used to print on bags, wrappers, cartons and boxes. Recently, flexographic printing is being used outside of the packaging field, particularly for books, magazines, stationery and the like A good discussion of flexographic printing is found in "Machine Printing" by Durrant, Meacock and Whitworth, copyright 1973 by Hastings House Publishers, New York, N.Y.

It has previously been proposed to separate inks of different characteristics, for example of different colors with respect to actual zones on an ink ductor roller against which at least one and usually two doctor blades are engaged, see, for exam U.S. application, Ser. No. 921,338, filed Oct. 21, 1986, now U.S. Pat. No. 4,754,701 Batke et al. This application is directed to a system in which a separating plate is located beneath an axially extending doctor blade. The separating plate has a sealing element attached thereto, resiliently engaging the underside of two doctor blades facing the ductor or trough roller from different directions to permit operation of the ductor or trough roller in either direction of rotation. A low friction surface is applied to the edge which faces the doctor blades, the sealing elements spanning the space between the doctor blades and being matched to the circumference of the ductor or trough roller. The doctor blades extend axially beyond the sealing elements. The separating plates and sealing elements can be mounted on units which are actually positioned along on ink trough and hence the ductor or trough roller, at selected positions, as required by the axial extent of different colored inking zones.

German Patent Disclosure Document DE-OS No. 23 20 638, referred to in the aforementioned Batke patent application, describes an arrangement in which two ink separating sheet metal elements are engaged by spring force directly to the circumference of a ductor roller in order to separate differently colored inks from each other. The lateral sealing of the ink reservoir or ink sump region is obtained by engaging the separating elements against the faced surface of the doctor blades or stripper blades.

THE INVENTION

It is an object to provide a flexible arrangement to separate axial zones on an anilox roller for a flexographic printing machine so that inks of different characteristics, for example of different color can be supplied to the respective zones, without overlap; which is simple, inexpensive and provides for effective sealing of the axial zones with respect to each other.

Briefly, a separating strip element preferably having a low friction surface has a curved surface fitting against and matching the surface of the anilox roller. The curved surface extends over a portion of the circumference thereof. To positively separate the inks of different characteristics, thus preventing migration of ink between the two or more ink zones and to eliminate the effect of abrasion in the water based flexographic inks, a thin film of a hydraulic separating liquid is placed between the strip element and the surface of the anilox roller. Typically,the strip element is made of "Teflon" ®, and the separating liquid is water. Other separating liquids, like water-alcohol mixtures, or ink solvents may be used. The liquid film applied to the region beneath the strip by placing two liquid saturable elements adjacent the end portions of the strip elements. Felt is a preferred material; other spongy materials can be used. Liquid is introduced to the felt elements, which will operate as wicks, to place the thin liquid film just in the region of the separating strip. "Teflon" is a polytetrafluoroethylene plastic.

In accordance with the preferred feature of the invention, the strip element is backed by silicone rubber, for example, of the low durameter type. This permits the seal to become self aligning regardless of direction of rotation of the anilox roller.

Anilox rollers are customarily used with doctor blades. In accordance with the feature of the invention, the doctor blades are cut, or made such that they terminate at the separating elements. The rubber back up permits sealing the corners of the doctor blade inside the ink chambers adjacent to the ink separators, and thus effectively seals the edges of the doctor blades as well, by plastic deformation of the silicone rubber, that is, bulging over the edge upon application of pressure.

In accordance with another feature of the invention, the fountain system is so arranged that a holder structure for the separating strip element, the back-up rubber, and the felt pads or, preferably, the entire ink fountain can be moved for selective engagement of either one of the doctor blades with the anilox roller, in dependence on the direction of rotation of the anilox roller and, further, so moved that both doctor blades clear the anilox roller, while the separating element and preferably also the pads remain in engagement with the surface of the anilox roller. This has the advantage that, during non-printing periods, the anilox roller can be permitted to continue to rotate, with ink being circulated in the ink fountain, thereby preventing drying of the ink on the anilox roller without, however, engaging one of the doctor blades with the anilox roller thereby substantially reducing wear and tear on both the anilox roller as well as the respective doctor blade or blades.

DRAWINGS

FIG. 1 is a general perspective view of a flexographic inker,(wherein the anilox roller is shown in phantom), subdivided axially, in accordance with the present invention;

FIG. 2 is a schematic axial cross sectional view through an anilox roller and showing the ink separator in accordance with the present invention.

DETAILED DESCRIPTION

An anilox roller **10**, of standard construction, and for example of about 28 cm diameter (about 11") is separated into axial zones, corresponding to axial zones **10***a*, **10***b*, or more, in dependence on requirements of the fountain. A separator element **2**, for example of plastic—nylon being suitable—is retained in a suitable portion of the ink fountain, shown only schematically at **11** by screws **12**. Fountain **11**, defining an ink cavity **11***a* is

retained on the machine frame as well known. It can pivot slightly about an axis **11b** (FIG. 2) perpendicular to the plane of FIG. 2. The separator element is narrow, and extends over a portion of the circumference of the anilox roller **10**. separator element **2** is formed with a cutout **13** into which a "Teflon"seal **3**, backed up a silicone rubber back-up element **5** is placed. For newspaper printing, a width of the elements **3**, **5** of about 15 mm is suitable.

The silicone rubber back-up element **5** uniformly distributes the pressure of the "Teflon" separator strip **3** about the circumference of the anilox roller. Compressive force of the silicone rubber can be obtained by pressure against the anilox roller **10**. Thus, the pressure of the separator strip **3** against the anilox roller can be controlled.

In accordance of the feature of the invention, a thin film of liquid, typically water, is applied between the anilox roller **10** and the "Teflon" separator strip **3**. This thin film of water is derived from two felt pads **21**, **31**, which are supplied with water from a water supply duct system. The water supply duct system is formed by a hollow bolts **14a**, **14b**, which, are threaded into the separating element **2**, and communicate with ducts **15a**, **15b** formed in the separating element and terminating at the felt strips **21**, **31**, respectively. The shapes of the ducts can be matched to any suitable requirement, for example straight, as shown at **15a**, or angled or bent as shown at **15b**. A water trough **29**, located beneath the entire assembly, receives any excess or dripping water.

The bolts **14a**, **14b** are threaded at the outside, and nuts **16a** **16b** though not necessary, may be used to retain the bolts against the frame **11**. The bolts **14a**, **14b** are coupled by suitable hydraulic coupling **17a**, **17b** to a hydraulic supply line, shown schematically and including such common hydraulic elements as elbows, unions and the like, as well as, valves **18a**, **18b**. Water then can be supplied selectively to the respective felt strips **21**, **31**. The felt strips **21**, **31** are held in position on the separator element **2** by retaining plates **22**, **32**, which engage the felt strips **21**, **31**, from both lateral sides; only one of the clamping plates **22**, **32**, is visible in FIG. 2.

Doctor blades **23**, **33** are selectively engaged with the surface of the anilox roller, and extend axially, that is, perpendicular to the plane of the drawing of FIG. 2. They are secured in position in the fountain. To provide for selective engagement of the doctor blades **23**, **33** in dependence on roller rotation, the fountain is pivoted about pivot axis **11b**. The doctor blades can be pressed axially into the silicone rubber back-up **5**, which will slightly compress and bulge around the doctor blade as schematically shown at **23**, **24**, thus providing a tight seal thereagainst. Preferably, the "Teflon" strip **3** is formed with sharp corners. The "Teflon" strip **3** and the silicone rubber back-up **5** can be seated in the recess **13** by being adhered therein, for example by a pressure sensitive adhesive.

The water ducts through the bolts **14a**, **14b**, and the connecting ducts **15a**, **15b** through the separator element **2** can be quite small, for example about two to three mm in diameter, just enough to drip water to the pads **21**, **31**, so that a hydraulic film will form beneath the "Teflon" ® strip **3**, to separate adjacent axial zones **10a**, **10b** . . . . and corresponding zones on the anilox roller. The circumferential length of the felt strips, for a roller of about 28 cm diameter can be about 7 to 8 cm.

Applying a thin film of water between the "Teflon" strip **3** and the surface of the anilox roller **10** has the advantage that the separator strip will not damage the anilox roller and provide a seal with an extended life span which, additionally, is not affected by high rotational speed of the anilox roller **10**. Using water as a film liquid has an additional advantage because it prevents drying of flexographic ink on the anilox roller in the region of ink separation, thus eliminating the abrasive characteristics of water based inks, which otherwise cause wear of sealing material due to build up of dry ink on the anilox roller.

The amount and direction of water flow to be used can readily be controlled by operation of a three way valve **18** in the water supply system to the ducts **15a**, **15b**. The quantity can be easily determined by experimentation; just enough water should be used so that the ink separator region does not dry or harden on the anilox roller. Besides the interaction of the water film with the ink, the water will additionally act as a lubricant, and form a hydraulic film around the circumference of the anilox roller. Thus, the "Teflon" strip **3** will ride on the film, and even though the pressure may be considerable, the effect will be similar to that of planing of rolling automobile tires on a road surface which is wetted. This hydraulic film effectively eliminates friction, and prolongs the life of the seal. Just as in planing of automotive tires on a road surface, the friction is low.

Ink migration across the separator is effectively inhibited since the hydraulic film permits liquid to remain only between the anilox roller and the "Teflon" seal, and, in turn, prevents the entrance of ink between the "Teflon" seal and the anilox roller. Thus, migration of ink of one c[characteristic, for example, of one color to ink of another characteristic, for example, of another color is effectively prevented.

Use of a separate rubber back-up **5** is not strictly necessary but preferred. It permits ready replacement and provides uniform even sealing pressure. A low durometer material, for example, a closed silicone rubber of 30 durometer, and located behind the "Teflon" sealing strip provides uniform, even sealing pressure against the face of the anilox roller. The low durometer silicone rubber between the wall of the separating element **2** and the "Teflon" seal also provides for effective sealing of the corners of the doctor blades. This type of silicone rubber permits about 20% compression, which causes the slight side expansion **24**,**25** of the silicone rubber around the blade ends and corners.

Various materials can be used to form the water film application elements **21**, **31**; felt is particularly suitable since it permits a metered dripping or application of water through the separator strip **3**. The water comes with the felt pads **21**,**31** located above and below the "Teflon" seal. The density of felt is such that an even distribution of water is obtained. The water seeps to the lower portion of the felt pads by gravity.

The arrangement has the additional advantage of low cost. Teflon is substantially more expensive silicone rubber or felt, and using a thin small strip of "Teflon" backed up by silicone rubber with felt pads on either side reduces the amount of "Teflon" used. The "Teflone" is only used in the areas of the ink fountain, between the upper and lower doctor blades.

In accordance with the feature of the invention, the entire ink fountain **11**, together with the separator element **2**, the strip element **3** the back-up element **5** thereof and the doctor blades **23**, **33** can be pivoted about the axis **11b**. The fountain **11** is retained on the machine frame by a bracket **40**, coupled to a holder rod

41 which can be pivoted about the pivot axis 11*b*, as shown schematically by arrow 42. The holder rod 41 is shown broken since the pivot axis 11*b* is usually further toward the left—with respect to FIG. 2—and would not normally be visible in the drawing, for example, being hidden by the valve 18. The location in FIG. 2 has been selected only for clarity of illustration. The fountain 11 is usually trough shaped, to define the ink cavity 11*a*. Ink is continously admitted to the ink cavity by inlet openings 45, and removed by outlet openings 46, ink being continuously circulated in the ink cavity. The anilox roller 10, engaged or just slightly spaced from the doctor blades 23, 33 prevents loss of ink.

In accordance with the feature of the invention, the ink fountain 11 can be removed with respect to the anilox roller 10 such that both doctor blades 23, 33 lose contact with the anilox roller 10. The movement is slight, a fraction of a millimeter. This permits continued circulation of flexographic ink in the ink trough 11*a*, and rotation of the anilox roller 10 at low or idle speed, thereby preventing drying of ink on the roller 10 during periods of time when printing is not being effected, while maintaining separation of inks of different colors, for example, in the different zones 10*a*, 10*b*. The strip, element 3 as well as the pads 21, 31 will expand slightly—after having been compressed—but not sufficient to lose contact with the anilox roller; if one, or both of the pads 21, 31, should lose contact over a portion of the surface, little harm is done; sufficient water will be applied to form a ring-shaped liquid film in alignment with strip 3 around the anilox roller 10 so that the strip 3 will ride, or plane on the ring-shaped film, thereby continuously preventing ink from the zones 10*a*, 10*b* from merging or bleeding over each other while still permitting rotation of the anilox roller, while it remains positioned in front of the ink cavity 11*a*. The movement of the ink trough so that the doctor blades 23, 33 clear—that is, just barely clear the roller 10, while permitting the back-up rubber 5 as well as the pads 21, 31 to expand can be obtained in any suitable manner; as shown in FIG. 1, a common shaft 50 extends longitudinally of the inker, parallel to the ink trough 11. It can be pivoted as shown by arrow 51. Shaft 50 is coupled by an angled lever 52 to the support rod 41, or the bracket 40, respectively of the separator element 2 tilt mechanism.

OPERATION

If the anilox roller 10 operates in clockwise, or forward rotation, the upper felt pad should be removed, and the upper drip system shut off, for example, by turning valve 18 to direct water to lower pad 31. The lower felt pad 31 remains in place and the lower drip or water application system is activated by valve 18 By wick action, pad 31 will apply a thin film of water on roller 10 which will permit strip 3 to ride on the film. Upon rotation of roller 10, a ring of water film will form on the roller 10, separating adjacent zones of ink. Fountain 11 is pivoted about axis 11*b*, see arrow 42, to disengage doctor blade 23. Rubber backing 5 will equalize engagement pressure of strip 3 against roller 10. Upon reversing rotation to counter clockwise or reverse anilox rotation, the lower drip system can be turned off by changing position of valve 18 and the lower felt pad 31 can be removed. The upper felt pad 21 remains in place and the upper drip system is activated. The non-wetted felt pads should be removed to prevent drying. Removal of the felt pad is simple, by merely slipping them out, possibly also loosening holding screws holding the respective clamping plate 22, 32, and then removing the respective felt strips 21, 31.

Under normal printing conditions, 10 may operate at speeds of up to about 800 rpm, for example. If the machine is not printing it has been customary to stop ink flow and engage in a "wash up", to prevent drying of the rapidly evaporating ink on the anilox roller 10 and in the fountain. In accordance with the feature of the present invention, however, the roller 10 can be permitted to continue to operate at idle speed, for example, at about 30 rpm, with ink continuously being circulated between inlets 45 and outlets 46—shown in FIG. 1 only in different ink zones—while separating the ink zones from each other. Upon tilting of shaft 50 in counterclock wise direction of arrow 51, both doctor blades 23 and 33 will be removed from engagement with the anilox roller 10. The tilt axis of shaft 50 is preferably in essential vertical alignment with the axis of rotation of anilox roller 10, and, for example, somewhat below the ink trough 29. The normal compression of the rubber backing 5, when printing, may be about 25% of its nominal., uncompressed thickness; that of the felt pads about 10%. Slightly tilting the fountain 11 permits some expansion of the rubber liner backing 5, and of the felt pads 21, 31, without loss of their function however. Thus, wash up can be eliminated during idling periods; the strip element 3 and the pads 21, 31 will remain in engagement with the roller 10, thus separating ink zones, while preserving the edges the doctor blades 23, 33 and the surface of the anilox roller.

Various changes and modifications may be made within the scope of the inventive concept.

I claim:

1. In a flexographic printing machine,
   an arrangement to separate an ink fountain (11) into different axial zones (10*a*, 10*b*) to permit use of inks of respectively different characteristics on various zones of an anilox roller (10) comprising
   a separating strip element (3)
   and means (21, 14*a*, 15*a*; 31, 14*b*, 15*b*; 18) for introducing a hydraulic film of a separating liquid between the surface of the strip element (3) and the surface of the anilox roller (10), including a pad element (21, 31) of a porous substance, positioned in alignment with said separating strip element (3);
   liquid supply means (14*a*, 15*a*; 14*b*, 15*b*) in hydraulic fluid communication with said pad element (21, 31) of the porous substance; and
   the separating strip element (3) having a curved low-friction surface fitting against and matching the surface of the anilox roller (10), positioned, with respect to the direction of rotation of the anilox roller, downstream from said pad element (21, 31), and extending over a portion of the circumference of the anilox roller,
   the hydraulic film forming a ring of liquid essentially only in the circumferential region of the anilox roller which includes said portion of the circumference thereof, to float the separating strip element (3) on said ring of separating liquid.

2. The arrangement according to claim 1 wherein said separating liquid comprises water.

3. An arrangement in accordance with claim 2 wherein two pad elements (21,31) and two liquid supply means are provided, the respective pad elements being located adjacent extreme ends of said separating strip element (3).

4. An arrangement in accordance with claim 2 wherein said pad element of porous substance comprise felt means.

5. An arrangement in accordance with claim 1 further comprising a back-up element (5) located adjacent the separating strip element (3) at a side thereof remote from said anilox roller (10), said, back-up element comprising a compressible material.

6. An arrangement in accordance with claim 5 wherein said compressible material comprises silicone rubber.

7. An arrangement in accordance with claim 5 further including a separator element (2) defining a holder structure, said holder structure being formed with a recess (13) extending part circumferentially around said anilox roller, said back-up element (5) being retained in said recess;

and adjustable means (12, 16a, 16b) adjustably engaging the separator element to provide an essentially radially directed force against said back-up element and to compress said compressible material and press the separator element (3) against the surface of the anilox roller (10).

8. An arrangement in accordance with claim 5 further including doctor blade means (23, 33) having an axial length extending up to the separator element, said doctor blade means (23, 33) engaging with an edge portion against said back-up element (5) of compressible material to permit the compressible material to bulge out against the doctor blade means and seal the edge of the doctor blade means.

9. An arrangement in accordance with claim 1 further comprising a separator element (2) defining a holder structure;

resilient support means (5) for resiliently supporting said strip element (3) on the holder structure for essentially uniform part-circular resilient engagement of the strip element with the anilox roller (10);

doctor blade means (23, 33) located on the ink fountain (11); and

means (41, 42; 50, 51, 52;) movably supporting the ink fountain for selective engagement with the doctor blade means with the anilox roller, or disengagement of the doctor blade means by a slight distance sufficient to clear the doctor blade means from the anilox roller while retaining resilient engagement of the strip element (3) with the anilox roller (10) and continued application of separating liquid to he anilox roller by said liquid application means.

10. An arrangement in accordance with claim 9 wherein said means for introducing the hydraulic film of the separating liquid comprises two wick-type pad elements (21, 31) of a porous substance, positioned in alignment with said strip element (3) at extreme ends of the strip elements;

two doctor blades are provided, forming said doctor blade means, a first doctor blade being associated with the anilox roller in one direction of rotation, and a second doctor blade being associated with the anilox roller in reverse direction of rotation;

and wherein the movable support means permits selective engagement with the anilox roller of

(a) the first doctor blade;

(b) the second doctor blade; and

(c) neither doctor blade,

while maintaining the anilox roller (10) in fluid transfer position with at least one of said pad elements (21, 31).

11. The arrangement of claim 1 wherein said separating liquid comprises at least one of water; water-alcohol mixtures; ink solvents.

12. In a flexographic printing machine, an ink fountain (11) including an arrangement to separate the fountain into different axial zones (10a, 10b . . .) to apply ink on an anilox roller (10) in different axial zones thereof and to permit use of inks of respectively different characteristics, for example of different colors, in the various zones

comprising

a separator (2) having a surface facing the anilox roller (10) which extends over a portion of the circumference thereof; said separator including

a separating strip element (3) having a curved surface of low friction material fitting against and matching the surface of the anilox roller;

a back-up means (5) of compressible material secured to said separator element, and retaining said separating strip element (3) in position, extending over a portion of the circumferential dimension of said separator element (2);

a pad element (21, 31) of a fluid pervious, porous substance retained on said separator element (2) adjacent the end portions of the separating strip element (3) and extending away from the end portions of the separating strip element;

fluid supply means (14a, 15a; 14b, 15b; 18) connecting a source of separating fluid to said pad element to apply a separating fluid thereto, and, in turn, form a film of separating fluid on the surface of the anilox roller (10) and between the surface of the anilox roller (10) and the separating strip element (3);

and means (12, 41, 42; 50, 51, 52) for engaging the separator element (2) towards the surface of the anilox roller (10).

13. The arrangement of claim 12 wherein said separating strip element comprises polytetrafluoroethylene; said back-up means comprises silicone rubber; and said pad element comprises a felt pad.

14. The arrangement of claim 12 wherein said separator (2) defines a holder structure;

two pad elements are provided, one each located at an extreme end of the separating strip element;

two doctor blades are provided, a first doctor blade (23) being associated with one direction of rotation of the anilox roller (10) and a second doctor blade (33) being associated with reverse direction of rotation of the anilox roller,

said doctor blades being secured to said ink fountain;

and wherein the engagement means for engaging the separator against the surface of the anilox roller include means (41, 42; 50, 51 52) for movably supporting the ink fountain for selective engagement of either one of said doctor blades with the anilox roller in dependence on the respective direction of rotation of the anilox roller, or disengagement of both doctor blades with the surface of the anilox roller by separating edges of the doctor blades from the surface of the anilox roller by a slight distance to clear the anilox roller while retaining resilient engagement of the separating strip element (3) with the anilox roller and of at least one of said pad elements with the anilox roller to continuously apply separating fluids to the anilox roller and form said film of separating fluid between the surface of the anilox roller and the surface of the separating strip element.

15. The arrangement of claim 12, wherein said separating liquid comprises at least one of: water; water-alcohol mixtures; ink solvents.

16. A method of sealing flexographic printing inks or different colors from each other and separating said inks in axial zones of an anilox roller (10) comprising the steps of:

providing a separating strip element (3) having a low-friction surface which is curved, matches the surface of the anilox roller (10), and extends over a portion of the circumference thereof;

forming a circumferential ring of a film of separating liquid between said zones by applying a porous wick-like pad against the surface of the anilox roller and saturation said pad with said liquid;

resiliently engaging said separating strip element against said ring of the film of separating liquid;

floating said separating element on said film; and said step of forming the circumferential ring of the film of separating liquid comprises

introducing just enough liquid upstream, in the direction of rotation of the anilox roller, to provide for effectively planing of the separating strip over the film of liquid.

17. Method according to claim 16 wherein said liquid comprises water.

18. Method according to claim 16 for use in a flexographic printing machine having two doctor blades (23, 33) selectively engagable with the anilox roller (10), or separable therefrom,

wherein the step of introducing said film of liquid comprises maintaining said film of liquid on the anilox roller and continuing to float the separating element on said film when the doctor blades are separated from the anilox roller.

19. Method according to claim 16 wherein said separating liquid comprises at least one of: water; water alcohol mixtures; ink solvents.

* * * * *

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United States Patent [19]

Bird

[11] **Patent Number:** **4,796,556**

[45] **Date of Patent:** **Jan. 10, 1989**

[54] **ADJUSTABLE COATING AND PRINTING APPARATUS**

[75] Inventor: **John W. Bird,** Westport, Conn.

[73] Assignee: **Birow, Inc.,** Westport, Conn.

[21] Appl. No.: **65,954**

[22] Filed: **Jun. 24, 1987**

[51] **Int. Cl.**[4] **B05C 11/00**

[52] **U.S. Cl.** **118/46;** 118/262; 101/177

[58] **Field of Search** 118/46, 262, 249; 101/177

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Primary Examiner—Shrive Beck

Assistant Examiner—Alain Bashore

Attorney, Agent, or Firm—Peaman & Green

[57] **ABSTRACT**

An offset lithographic printing machine having a plurality of in-line liquid application stations, at least one of which is an ink image printing station for printing lithographic ink images onto suitable receptive copy sheets, and the final downstream liquid-application station being a coating application station for printing a protective, and/or aesthetic coating over selected portions of, or over the entire ink image-printed surface of the copy sheets. The coating application station comprises a plate cylinder adapted to print liquid coating composition onto predetermined selected areas of the ink image-printed copy sheets by offset-transfer to an intermediate blanket cylinder, a said blanket cylinder adapted to receive said liquid coating composition from the plate cylinder for retransfer onto predetermined selected image-printed areas of the image-printed copy sheets, and also adapted to receive a continuous liquid coating composition for retransfer as a continuous overall coating over the image printed areas of the image printed copy sheets. An adjustable coating-application carriage is supported for movement into coating association with either the plate cylinder blanket cylinder desired, for the application of a printed coating over either preselected limited areas or over the entire image-printed surface of the copy sheets.

23 Claims, 4 Drawing Sheets

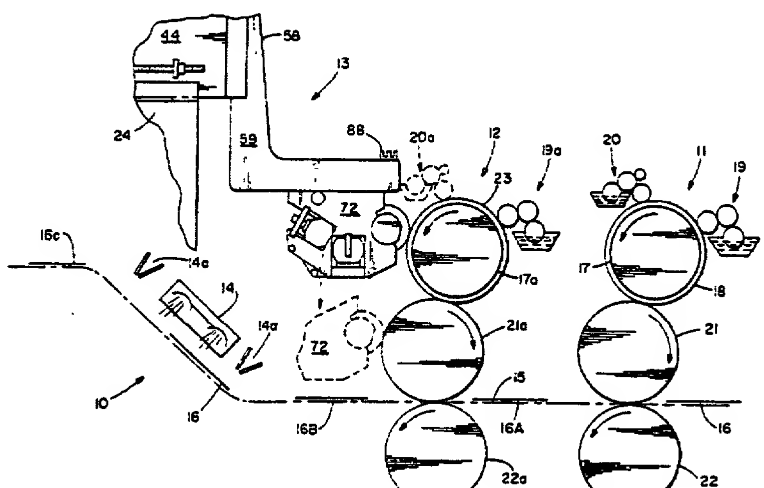

FIG. 1

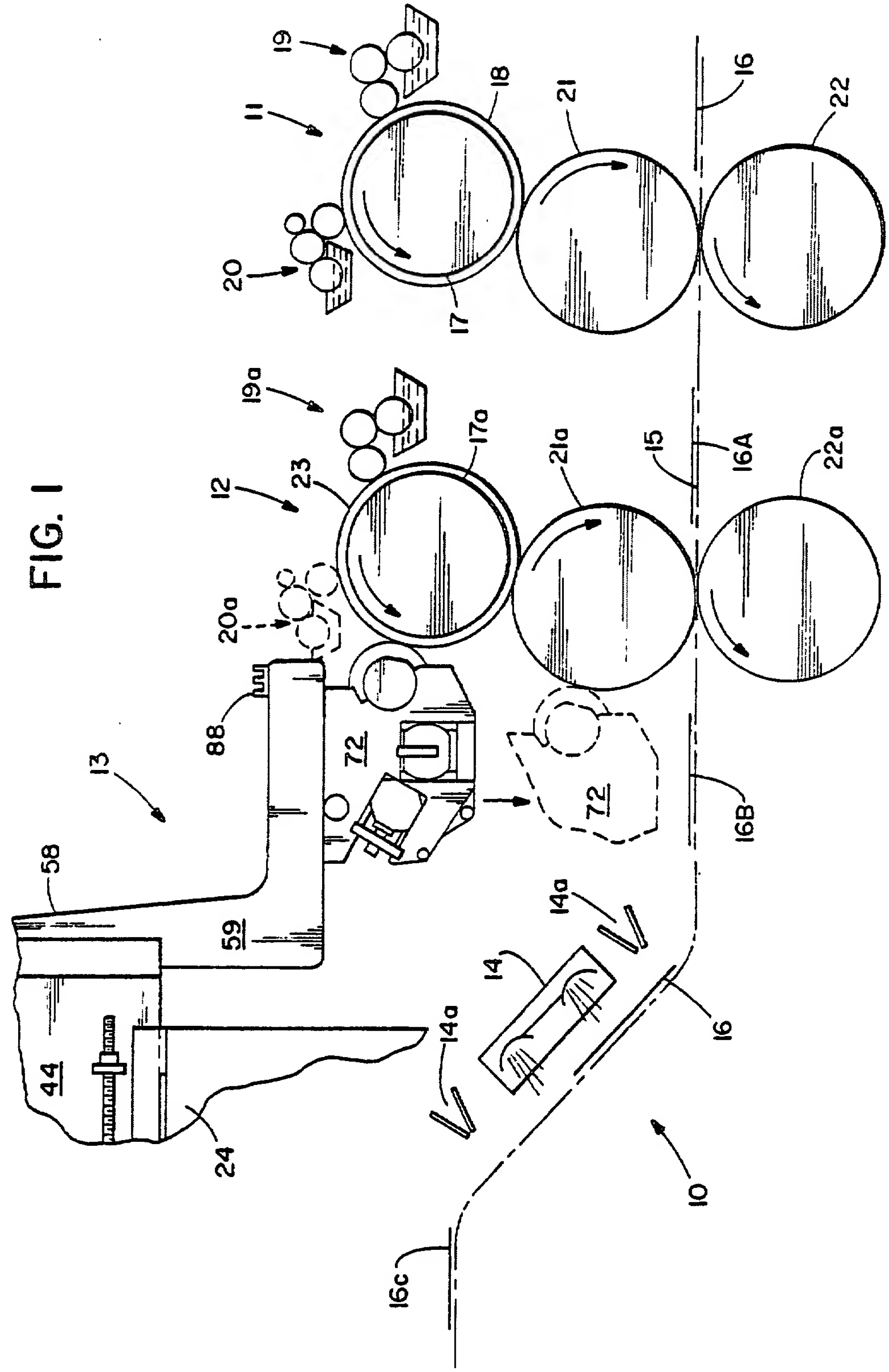

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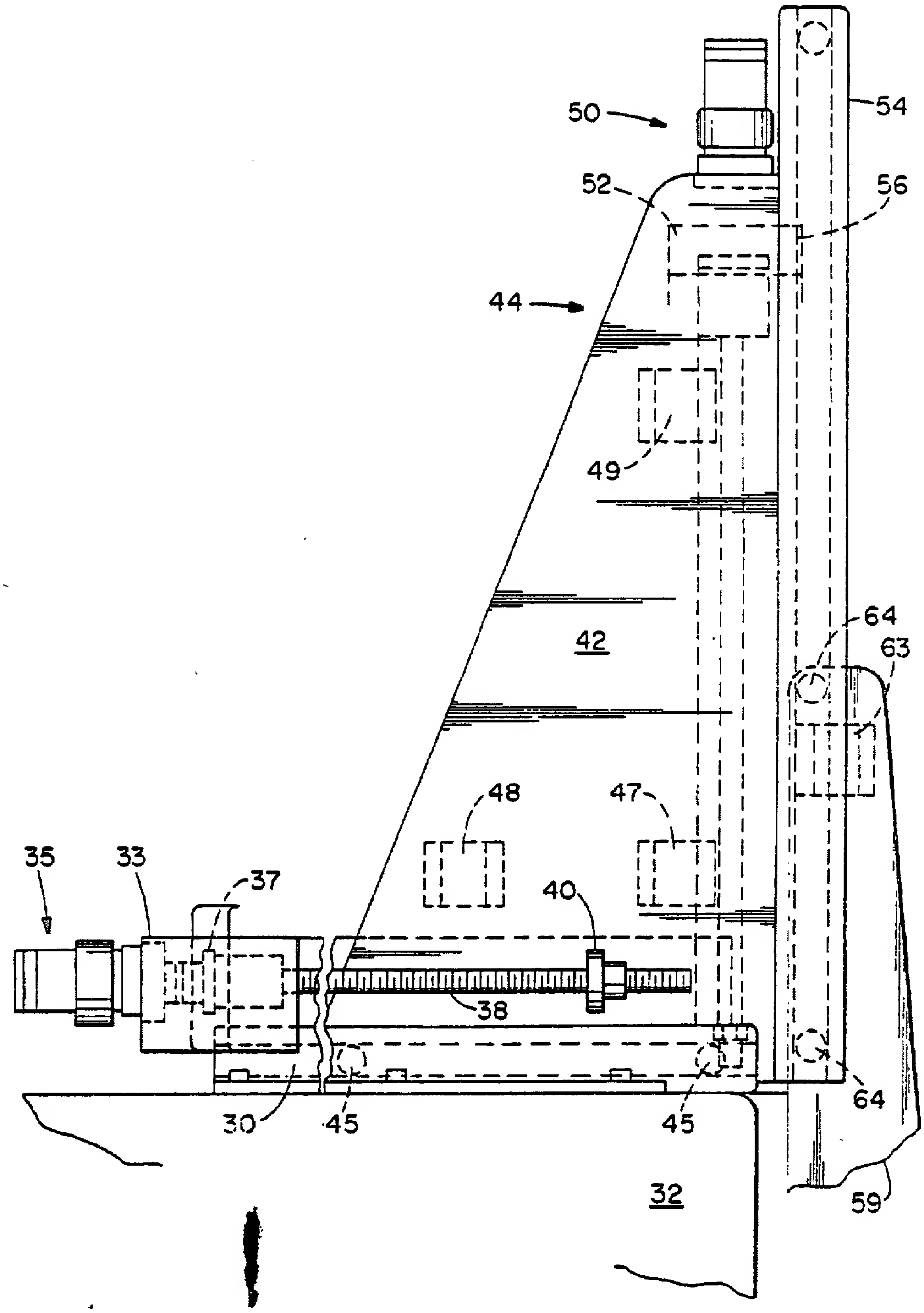
FIG. 2A



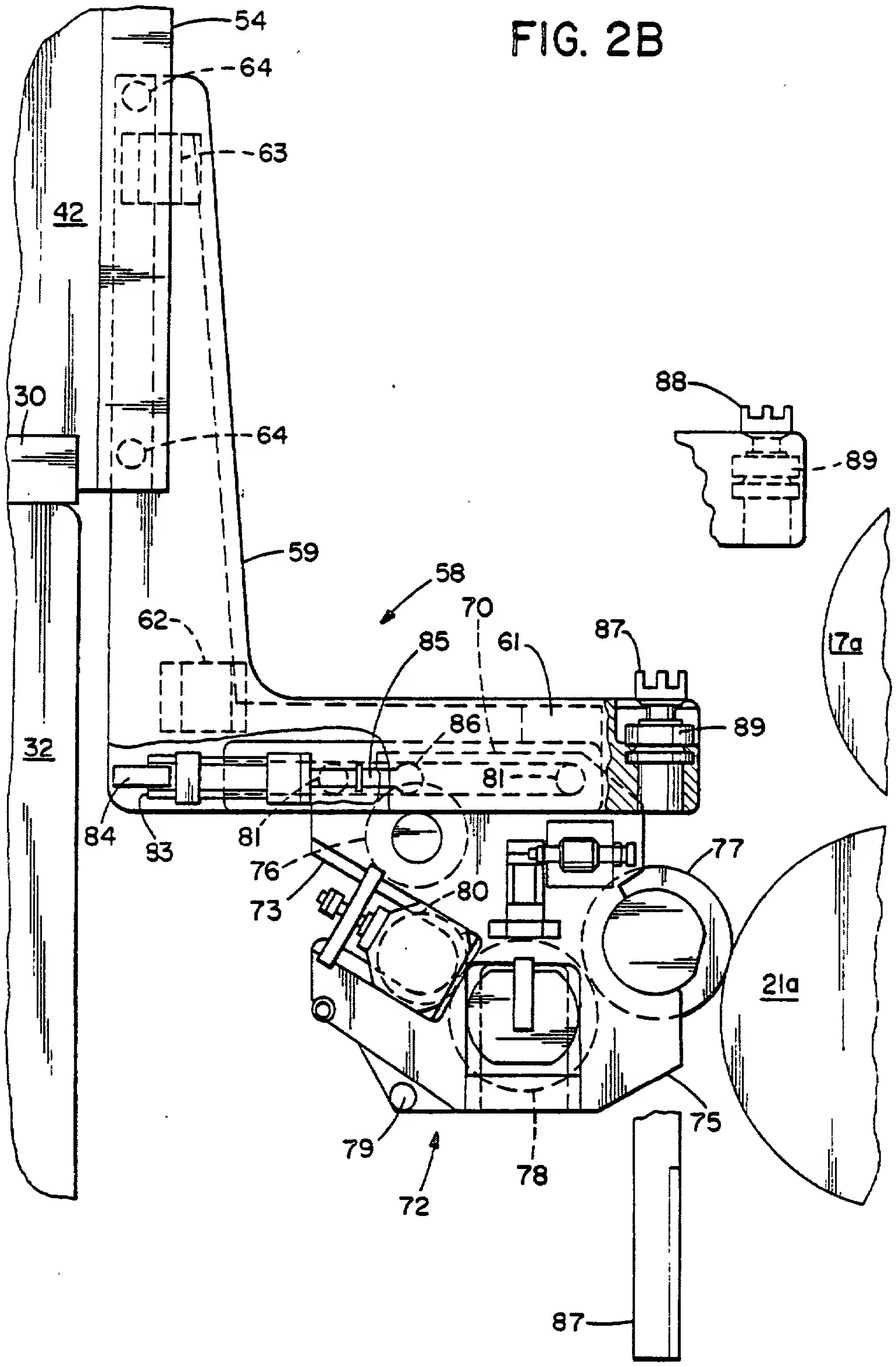

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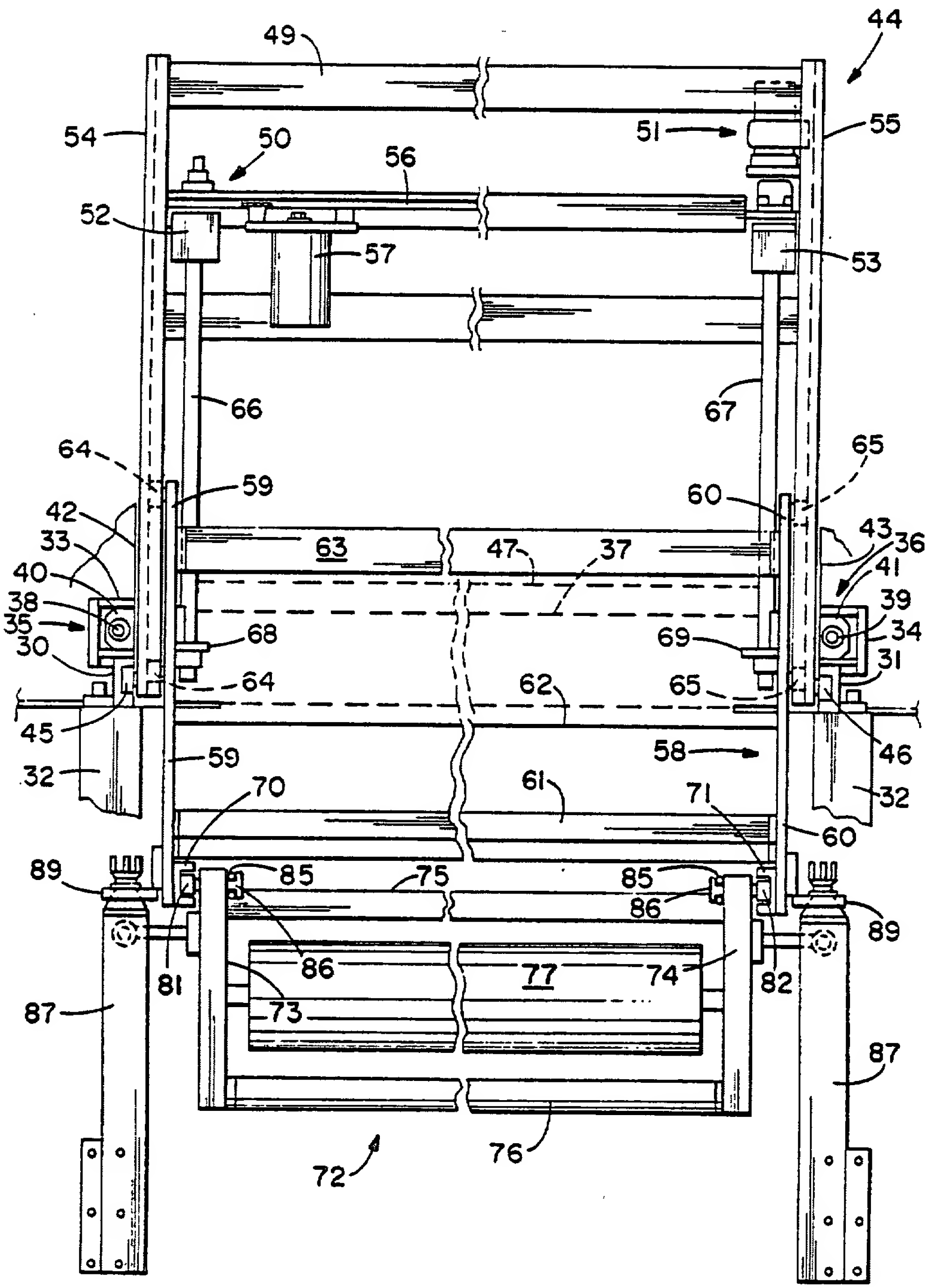
FIG. 2B

FIG. 3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ADJUSTABLE COATING AND PRINTING APPARATUS

BACKGROUND OF THE INVENTION

Conventional lithographic offset printing machines or presses comprise one or more image printing stations each having a printing roll (sometimes referred to as a plate cylinder) to which is fastened a thin hydrophilic, oleophobic printing plate having image areas which are oleophilic and hyrdoprobic and background areas which are oleophobic and hydrophilic. The plate surface is continuously wetted with aqueous' damping solution which adheres only to the background areas, and inked with oleoresinous ink which adheres only to the image areas of the plate as wet ink. The ink is offset transferred to the rubber surface of a contacting blanket roll (sometimes referred to as a blanket cylinder), and then retransferred to the receptive surface of a copy web or a succession of copy sheets, such as of paper, where the ink air-dries by oxidation and curing after passing through a drying station.

Since image-drying is gradual, it is conventional to spray the printed copies with starch or other "stilting" powder before the copies are stacked. This prevents sticking of the ink images to adjacent copies and also permits the circulation of air for the oxidation curing process.

In cases where cost is not a factor and/or where the aesthetic advantages of a protective supercoating are desired, it is known to provide the printing machine with a downstream coating station having a blanket roll associated with a coating application unit for the application of an overall protective coating over the entire printed area of the copy sheets or web. This also avoids the necessity of powdering the printed images. Reference is made to U.S. Pat. No. 4,270,483 for its disclosure of such an apparatus. The coating unit of U.S. Pat. No. 4,270,483 is pivotally-associated with the blanket roll for movement between coating and noncoating or retracted positions.

It is known to apply pattern coatings of protective composition by means of blanket rolls by cutting into the rubber surface of the blanket to leave raised or relief surface islands which selectively receive the coating composition from the application roll for retransfer to selected areas of the copy sheets in the form of pattern coatings. This procedure has several disadvantages. The make-ready time required for the preparation of such relief blanket rolls is excessive and the procedure requires the tedious, precision efforts of an expert in order to approximate the required registration, whereas precise relief printing plates used on a printing roll can be produced photographically in a short period of time with a minimum of effort and expertise. Moreover, the attachment of a relief printing plate to a plate cylinder provides some degree of adjustability, axially as well as circumferentially, to provide better registration if necessary, whereas no adjustment of the relief portions is possible relative to the blanket roll or cylinder.

Protective coating compositions also improve the appearance of printed documents, particularly high quality, multi-color copies such as posters, record jackets, product brochures, etc., by providing glossy or matte finishes over the entire image-printed surface or over selected image-printed portions thereof such as photographs, product illustrations, etc. Selected area coating, spot coating or perfect registration over predetermined limited printed areas of the copies is advantageous from a cost standpoint since the coating compositions are relatively expensive and the volume required is reduced if the coating is only printed in registration where desired. Also, spot coating is frequently used as a means for highlighting certain portions of the printed copies such as company name or logo, product illustrations, photographs, etc.

While the cost of the protective coating compositions is an important factor, a more important cost factor is the necessity of removing the printed copies from an offset printing press and then running them a second time through a coating machine to print either a full protective coating or a spot protective coating, as desired. This problem is overcome by U.S. Pat. No. 4,270,483 with respect to the in-line printing of overall or continuous protective coatings but the problem of providing in-line spot printing of protective coatings with a minimum of make-ready time and a high degree of precision thickness remains.

SUMMARY OF THE INVENTION

An essential objective of the present invention is to provide a printing machine or press for the printing of imaged subject matter onto a receptive substrate, such as a copy web or a succession of copy sheets, said printing machine having a downstream coating station designed for the application of either continuous or spot coatings, as desired, over the image-printed copies in a continuous in-line process.

Another object of the present invention is to provide a coating apparatus designed to be mounted at the final downstream ink-application station of a conventional offset printing machine or press having a plurality of ink-application stations to convert said machine or press, intermittently if desired, to the in-line application of either continuous or spot coatings, as desired.

Yet another object of this invention is the provision of a single coating application apparatus mounted in association with the final downstream liquid application station of a printing press having a plurality of liquid application stations, each having a plate cylinder, a blanket cylinder and an impression cylinder, the coating application apparatus comprising a coating carriage which is adjustable between one coating position in which it coats the plate cylinder and another coating position in which it coats the blanket cylinder of the final downstream station to convert said station to a coating station for the application of either spot or continuous coatings to the surface of the image-printed copies.

The novel apparatus of the present invention comprises a coating application apparatus for an offset printing machine and a printing machine containing such an apparatus, the coating application apparatus having a movable carriage designed for operative association in one position with the plate cylinder and in another position with the blanket cylinder of the final liquid application station of the offset printing machine, the coating carriage being adjustably supported for automatic movement between said two different coating positions. One coating position brings the coating application roll of the carriage into coating association with the plate cylinder for the offset formation of predetermined printed spot coatings onto predetermined image-printed areas of the copy sheets. The other coating position brings the coating application roll of the car-

riage into coating association with the blanket cylinder for the offset formation of a continuous coating onto the entire image-printed surface of the copy sheets. This enables the printing machine to image-print and coat-print the copy web or sheets in a continuous in-line operation, the apparatus being adjustable in simple fashion with a minimum make-ready time to adapt the coat-print step to the application of either spot coatings or continuous coatings depending upon the requirements of the printing operation. This increases the versatility of the offset printing machine, avoids the need for separate printing machines or for separate runs of the printed stock and enables the in-line precise printing of spot coatings in tight register and adjustable thickness, which was not possible with any prior-known offset printing machine.

The novel apparatus of the present invention enables the final downstream liquid application station of the printing machine to be used as either an ink-printing station or as a coating-application station and permits simple and rapid conversion between such utilities.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical cross-sectional view through two downstream liquid application stations of an offset printing machine, illustrating a coating-application unit according to one embodiment of the present invention;

FIGS. 2A and 2B are segmented, detailed side views of coating application unit of FIG. 1 and

FIG. 3 is a horizontal front view of the coating application unit of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings, FIG. 1 illustrates a downstream portion of an offset printing machine 10 comprising two liquid application stations 11 and 12, the latter including a coating apparatus 13 comprising a coating carriage 58, a radiation drying station 14 including air knives 14a, and a continuous copy sheet gripper system 15 which moves a succession of copy sheets 16 through the printing machine.

The first liquid application station 11 is a conventional offset image printing station comprising a plate cylinder 17, to which is clamped an imaged lithographic printing plate 18 carrying oleophilic image areas, such as words, photographs, etc. on an oleophilic background. The conventional clamping means permits some degree of lateral or axial adjustment and some degree of wrap-around or circumferential adjustment of the plate 18 relative to the plate cylinder 17. Plate cylinder 17 is associated with a dampening system 19 for wetting the entire background surface of plate 18 with aqueous dampening fluid, and with an inking system 20 for inking the imaged areas of the plate 18 with liquid oleoresinous ink.

The inked plate 18 is rotated against the ink receptive surface of a blanket cylinder 21, to which the wet ink images are offset or transferred, and the blanket cylinder 21 is rotated against a copy sheet 16, passed in the nip between the blanket cylinder 21 and an impression cylinder 22, to transfer the wet ink images to the copy sheet 16 and form an image-printed copy sheet 16A which is conveyed to the last liquid application station 12 which includes the coatingapplication apparatus of the present apparatus.

The coating application station 12 can be similar to the inking station 11 with respect to the plate cylinder 17a supporting a printing plate dampening system 19a, blanket cylinder 21a and impression cylinder 22a since in a conventional offset printing machine having a plurality of liquid application stations, all of the stations are generally similar but use different printing plates to image different areas of the same copy sheet with different colored inks. The present apparatus modifies the final downstream inking station to convert it permanently or intermittently to a versatile coating station.

Plate 23 is an offset relief printing plate, preselected areas of which are raised above the background, generally referred to as "relief spots". Such spots are sized and positioned to correspond to areas of the image-printed copy sheets 16a which it is desired to selectively coat.

The essential novelty of the apparatus of FIG. 1 resides in the adjustable coating apparatus 13 which is mounted onto the frame 24 of the printing machine for extension of the coating carriage 58 into the liquid application station 12 for adjustable coating association with either the coating plate cylinder 17a or the coating blanket cylinder 21a, as desired.

The coating application apparatus 13, shown in greater detail in FIGS. 2 and 3, comprises a preferred embodiment of the present invention in that it includes a coating carriage 58 which is horizontally adjustably, in the machine direction, for movement between retracted or passive position and extended or active position, and also vertically adjustable for movement between the levels of the plate cylinder and the blanket cylinder. Moreover, the coating carriage 58 comprises a horizontally adjustable coating applicator unit 72 which is movable in the machine direction between different extended coating positions to accommodate plate and blanket cylinders which are not in vertical alignment, as shown by FIGS. 1 and 2B.

The coating application apparatus 13 of FIGS. 2A and 3 comprises a spaced pair of parallel, horizontal support rails 30 and 31 or legs designed to be bolted to frame portions 32 of the printing machine beyond station 12, rails 30 and 31 each being fastened to a gear housing 33, 34 of a hydraulic horizontal screw drive member 35, 36 connected to each other for simultaneous operation by a drive chain 37. The screw drive members 35 and 36 comprise reversible drive screws 38, 39 which threadably engage nuts 40, 41 which are fixed to the spaced vertical walls 42, 43 of the vertical lift housing 44.

Housing 44 is provided adjacent the bases of walls 42 and 43 with outward projecting cam follower or wheel pairs 45, 46 which are engaged within the horizontal tracks of the rails 30 and 31 to support the vertical lift housing 44 for horizontal movement between extended or active position, illustrated by FIGS. 1 and 2B, and retracted or passive position under the effects of hydraulic activation of the screw drive members 35 and 36. Walls 42 and 43 of housing 44 are fastened together and reinforced by cross-beams 47, 48 and 49.

Vertical or height adjustment of the coating application carriage 58 is made possible by a second pair of associated vertical screw drive members 50 and 51, shown most clearly in FIG. 3, each having a gear housing 52, 53 attached to the upper end of a vertical rail member, 54, 55 of the housing 44, and being connected to each other for simultaneous reversible operation by means of a drive chain 56 through a hydraulic motor 57.

Vertical lift housing 44 supports the vertically adjustable carriage 58 which comprises a spaced pair of L-

shaped side wall members 59 and 60 fastened together by cross-beams 61, 62 and 63. The vertical extensions of wall members 59 and 60 are provided with cam follower or wheel pairs 64, 65 which ride within the vertical tracks of rail members 54 and 55 on the inside of housing walls 42, 43 to raise and lower the vertical carriage section 58 under the activation of the screw drive members 50 and 51 since the drive screws 66 and 67 thereof threadably engage nuts 68 and 69, respectively, which are fastened to the lower ends of the vertical extensions of the L-shaped wall members 59 and 60.

The horizontal extensions of the L-shaped wall members 59 and 60 of the carriage 58 comprise lower horizontal track members 70 and 71 which support the coating application unit 72 of the carriage for horizontal adjustment therewithin.

Coating application unit 72 of carriage 58 comprises spaced, parallel side frames 73 and 74 fastened together by cross members 75 and 76 and supporting coating applicator roll 77, pick-up roll 78 positioned to pick up liquid coating composition from the coating pan 79, and adjustable metering roll 80 positioned to control the amount of coating composition passed by the pick-up roll 78 to the applicator roll 77. The outer surfaces of the side frames 73 and 74 are provided adjacent the top edge of each with a spaced pair of cam followers or wheels 81, 82 which ride within the horizontal tracks of the track members 70, 71 of the L-shaped wall members 59 and 60, to support the coating applicator unit 72 for adjustable horizontal movement within the carriage 58.

As shown by FIG. 2, movement of the coating unit 72 is controlled by a pair of hydraulic cylinders 83 each attached by a bracket 84 to an L-shapedwall member 59, 60 in horizontal alignment with the track members 70 and 71, and having their rod end 85 attached to the inside wall of side frames 73, 74 at posts 86. Activation of the hydraulic cylinders causes the coating unit 72 to move horizontally along track members 70 and 71 to position the leading edge of the applicator roll 77 for coating association with either the coating blanket cylinder 21a, as shown in FIG. 2B, or the coating plate cylinder 17a, as shown in FIG. 1. Preferably the printing machine frame is provided with spaced pairs of latch posts 87 and 88 or support brackets associated with the location of the blanket cylinder 21a and the plate cylinder 17a for engagement within latch brackets 89 attached to the outer surfaces of the horizontal extensions of the L-shaped wall members 59 and 60 in the area of the forward end of the track members 70 and 71. The engagement of the fixed latch post pair 87 within the latch brackets 89 secures the coating applicator carriage 72 in one position for coating the blanket cylinder 21a, as shown in FIGS. 2B and 3, while the engagement of the fixed latch post pair 88, shown by broken lines in FIG. 2B, within the same latch brackets 89 secures the coating applicator carriage 72 in another position, shown in FIG. 1, for coating the plate cylinder 17a. Such engagement requires a presetting of the sequence and duration of operation of the various hydraulic mechanisms. Engagement and disengagement of the latch brackets 89 on posts 87 and 88 requires vertical movement of the carriage 58 within the vertical lift housing 44 by predetermined directional and timed activation of the vertical screw drive members 50 and 51. Vertical alignment of the latch brackets 89 with the latch post pairs 87 and 88 must first be accomplished. This requires horizontal movement of the vertical lift housing 44 supporting the carriage 58 including the coating applicator unit 72, and is accomplished by predetermined directional and timed activation of the horizontal screw drive members 35 and 36, for movement of the vertical lift housing 44 from retracted, non-coating position to extended, aligned position. Movement of the coating applicator unit 72 into coating position requires predetermined directional and timed activation of the horizontal hydraulic cylinders 83. Adjustable stop members may be incorporated to limit the various movements.

As will be clear to those skilled in the offset printing art, the novel printing and coating apparatus of the present invention enables the modification of a conventional offset printing machine having a plurality of liquid application stations to convert it to a printing and coating apparatus which is adjustable in simple manner for the alternative application of either full coatings or spot coatings. Moreover, such modification may be temporary, if desired, so that the final downstream liquid application station may be used for its intended purpose for the application of printed ink images or for its modified purpose for printing overall or spot coatings. The conversion from printing use to spot coating use merely requires retracting or disengaging the ink applicator roll of unit 20a to position shown by broken lines in FIG. 1, replacing the image printing plate on plate cylinder 17a with a relief coating plate 23, cleaning the surface of the blanket cylinder 21a and moving the coating application unit 13 horizontally from retracted position to extended position. If overall or complete coatings are desired it is only necessary to retract or disengage the plate cylinder 17a from coating association with the blanket cylinder 21a, without any alteration of the plate cylinder 17a or its printing plate 23 or ink application unit 20a.

The present coating applicator roll 77 has a substantially smaller diameter than that of the plate cylinder 17a or the blanket cylinder 21a, the diameters of which are equal. The speed of rotation of the applicator roll 77 is adjustable so that its surface speed may be the same as or slower or faster than the surface speed of cylinders 17a and 21a, or in reverse rotation thereto, to provide a brushing action relative thereto, if desired. Such brushing action provides a shearing of the coating composition in the nip therebetween, and a relatively heavy or thick direct deposit of coating composition on cylinders 17a and 21a in cases where the surface speed of roll 77 is faster than that of roll 17a or 21a. This is desirable particularly for the application of spot coatings, since the coating thickness is always split to about one-half as the spot coating is transferred from the relief plate 23 of plate cylinder 17a to the blanket cylinder 21a, and further, split to about one quarter when the spot coating is transferred from the blanket cylinder 21a to the printed copy sheets 16A. The effect of such inherent splitting is reduced by increasing the coating thickness on the relief areas of plate 23.

In cases where the coating composition is applied directly to the blanket cylinder 21a, for the application of continuous coatings to the printed copy sheets 16A, the plate cylinder 17a is retracted from contact with the blanket cylinder 21a so that the only coating split occurs during transfer from the blanket cylinder 21a to the imaged copy sheets 16A.

The offset printing machines to which the present invention applies are conventional machines and therefore the present disclosure does not include details regarding the support structure for the various rolls,

dampening units, inking units, sheet conveyor system, drying station, or copy sheet supplying and stacking stations. In most modern printing machines, the sheet conveyor system is not a gripper belt or chain but rather comprises automatic grippers on a series of contacting impression cylinders and transfer cylinders.

Also, the present coating compositions and systems for providing continuous supplies thereof to the coating applicator unit are conventional in the art.

The terms "vertically" and "horizontally" are used herein and in the appended claims to define general directions of movement, including angular vertical movement from one level to another and/or angular movement in the machine direction. For example, on printing machines where the coating plate cylinder is not in perfect vertical alignment above the blanket cylinder it may be preferable that the vertical rail or track of the vertical lift housing is inclined at an angle similar to the angle from vertical formed by a straight line contacting the surfaces of the plate cylinder and the blanket cylinder to be contacted by the coating applicator roll. Movement of the coating carriage along such an inclined vertical rail is both generally vertical and generally horizontal. Similarly the horizontal track members for the support legs of the apparatus and/or for the coating applicator unit may also be angular to provide some degree of vertical movement in cases where the design of the printing machine frame supporting the present apparatus makes it necessary or advantageous.

It is to be understood that the above described embodiments of the invention are illustrative only and that modifications throughout may occur to those skilled in the art. Accordingly, this invention is not to be regarded as limited to the embodiments disclosed herein, but is to be limited as defined by the appended claims.

What is claimed is:

1. An adjustable in-line coating application apparatus for attachment in association with a dowmnstream liquid application station of an offset printing machine having a plurality of liquid application stations, for converting said downstream liquid application station to a coating application station for applying either continuous or spot coatings over the printed surface of a succession of copy sheets carrying ink images printed thereon at one or more upstream liquid application stations, said downstream liquid application station containing a blanket cylinder positioned to contact said plurality of printed copy sheets and an offset plate cylinder in vertical elevation above said blanket cylinder and supported for adjustment into and out of coating association therewith, said coating application apparatus having vertical guide means, a coating carriage attached to said support for substantially vertical movement along said guide means, said carriage comprising a coating application unit, including a container for a supply of liquid coating composition and an elongate coating applicator roll supported to receive a uniform supply of said composition on the surface thereof and to transfer a uniform supply of said composition to the surface of either a plate cylinder or a blanket cylinder in coating association therewith, and mechanical adjustment means for moving said carriage on said guide means relative to said support vertically between elevations corresponding to the locations of the blanket cylinder and the plate cylinder of an offset printing machine in order to move said coating applicator roll into coating association with either said blanket cylinder or said plate cylinder, as desired.

2. An apparatus according to claim 1 in which the support for said coating application apparatus comprises a spaced pair of parallel elongate horizontal leg members designed to be fastened relative to the frame of an offset printing machine.

3. An apparatus according to claim 2 in which said support comprises a parallel pair of spaced vertical wall members which are fastened to each other to form a vertical guide means on a vertical lift housing for said coating carriage.

4. An apparatus according to claim 3 in which said horizontal leg members comprise horizontal tracks, and said vertical wall members are movably attached to said horizontal tracks to permit horizontal adjustment of the position of said vertical lift housing.

5. An apparatus according to claim 4 in which said coating carriage comprises a parallel pair of vertical side members which are fastened to each other to form said carriage, each said side member being supportingly-engaged by a vertical guide means on a wall member of the vertical lift housing for vertical movement of said carriage relative to said housing.

6. An apparatus according to claim 5 in which each of the vertical side members of the carriage includes a lower, horizontal support extension to which the coating application unit is attached.

7. An apparatus according to claim 6 in which the horizontal support extensions comprise horizontal tracks to which the coating applicator unit is attached to permit horizontal adjustment of the coating applicator unit on the carriage relative to the vertical lift housing.

8. An apparatus according to claim 1 in which said coating carriage comprises releasable latching means for securing the unit relative to the frame of an offset printing machine when the carriage is positioned for movement of the applicator unit into coating association with either the blanket cylinder or the plate cylinder.

9. An apparatus according to claim 5 comprising automatic mechanical means for moving said carriage vertically relative to said vertical lift housing, said means comprising a vertical screw drive assembly one end of which is fastened to a vertical side wall of said housing and the other end of which is fastened to an adjacent vertical side member of said carriage.

10. An apparatus according to claim 4 in which said horizontal adjustment of the position of the vertical lift housing is provided by at least one horizontal screw drive assembly one end of which is fastened to a horizontal leg member and the other end of which is fastened to an adjacent wall member of the vertical lift housing.

11. An assembly according to claim 7 which further comprises means for causing horizontal movement of the coating applicator unit relative to the coating carriage, said means comprising at least one horizontal drive member one end of which is fastened to the applicator unit and the other end of which is fastened to the horizontal support extension of the carriage.

12. An offset printing machine having a frame supporting a plurality of in-line liquid application stations, each station comprising a blanket cylinder positioned to contact a succession of copy sheets to apply liquid thereto, and an offset plate cylinder in printing association with said blanket cylinder to apply liquid to prede-

termined areas thereof for transfer to said blanket cylinder and retransfer to said copy sheets, the final downstream liquid application station comprising a liquid coating station for the application of continuous or spot coatings over areas of the copy sheets which are image-printed with ink in at least one upstream liquid application station which is an ink printing station, said liquid coating station having said plate cylinder and said blanket cylinder in vertical elevation relative to each other and comprising a coating application carriage including a coating applicator unit having a container for liquid coating composition and a coating applicator roll which receives a continuous supply of said liquid coating composition from said container, and vertical guide means for supporting said coating application carriage for mechanically-adjustable vertical movement along said guide means between a first coating elevation position in which said coating applicator roll is in coating association with said blanket cylinder and a second coating elevation position in which said coating applicator roll is in coating association with said plate cylinder, whereby said carriage can be moved mechanically to said first position to cause the application of a continuous liquid coating to the image printed surface of the copy sheets, and can be moved mechanically to said second position to cause the application of spot liquid coatings to predetermined limited areas of the image printed surface of the copy sheets.

13. A machine according to claim 12 in which said carriage is movable out of coating association with said blanket and/or plate cylinders and said final downstream liquid application station is adapted for alternative use as another ink printing station.

14. A machine according to claim 12 in which the means for supporting said coating application carriage includes a spaced pair of horizontal leg members designed to support the coating application carriage in association with final downstream liquid application station.

15. A machine according to claim 12 in which the means for supporting said coating application carriage includes a parallel pair of vertical wall members which are fastened to each other and to said guide means to form a vertical lift housing for said carriage.

16. A machine according to claim 15 in which said vertical wall members are movably attached to horizontal track members to permit horizontal adjustment of the position of said vertical lift housing relative to the blanket and plate cylinders.

17. A machine according to claim 16 in which said coating carriage comprises a parallel pair of vertical side members which are fastened to each other to form said carriage each said side member being supportingly engaged by a vertical guide means on a wall member of the vertical lift housing for vertical movement of said carriage relative to said housing and between at least said first and second coating positions.

18. A machine according to claim 17 in which each of said vertical side members of the carriage includes a lower horizontal support extension to which the coating applicator unit is attached.

19. A machine according to claim 18 in which said horizontal support extensions comprise horizontal tracks to which the coating applicator unit is attached to permit horizontal adjustment of the coating applicator unit relative to the coating carriage and the blanket and plate cylinders.

20. A machine according to claim 12 in which the frame of said machine includes first position latching means associated with the blanket cylinder, and second position latching means associated with the plate cylinder in said coating application station, and said coating carriage includes mating latching means which engage said position latching means when the carriage is moved into said first coating position and into said second coating position.

21. A machine according to claim 17 comprising automatic mechanical means for moving said carriage vertically relative to said vertical lift housing, said means comprising at least one vertical screw drive assembly one end of which is fastened to a vertical side wall of said housing and the other end of which is fastened to an adjacent vertical side member of said carriage.

22. A machine according to claim 16 which comprises automatic means for providing horizontal adjustment of the position of the vertical lift housing comprising at least one horizontal screw drive assembly one end of which is fastened to a horizontal track member and the other end of which is fastened to an adjacent wall member of the vertical lift housing.

23. A machine according to claim 19 which further comprises means for causing horizontal adjustment of the coating applicator unit relative to the coating carriage, said means comprising at least one horizontal drive member one end of which is fastened to the applicator unit and the other end of which is fastened to the horizontal support extension of the coating carriage.

* * * * *

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United States Patent [19]
Kota

[11] Patent Number: 4,815,413
[45] Date of Patent: Mar. 28, 1989

[54] VARNISHING APPARATUS FOR PRINTED SHEET

[75] Inventor: Toshio Kota, Ibaraki, Japan
[73] Assignee: Komori Printing Machinery Co., Ltd., Japan

[21] Appl. No.: 919,144
[22] Filed: Oct. 15, 1986
[51] Int. Cl.^{4} B05C 1/02
[52] U.S. Cl. 118/46; 118/249; 118/262
[58] Field of Search 118/46, 231, 262, 249

[56] References Cited

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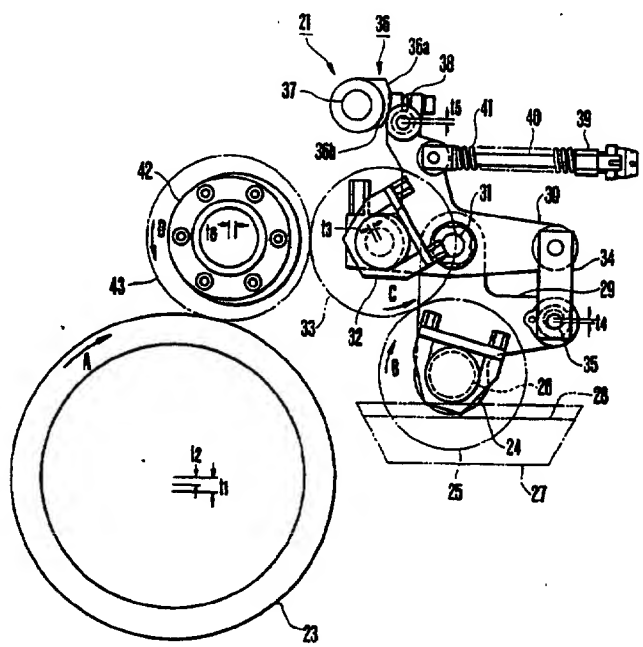
Primary Examiner—John McIntosh
Attorney, Agent, or Firm—Remy J. VanOphem

[57] ABSTRACT

A varnishing apparatus for a printed sheet includes: a metering roller, to a peripheral surface of which a varnish from a varnish duct is transferred; a form roller which is brought into contact with a downstream side of the metering roller and is rotated in the same direction as that of the metering roller to allow transfer of the varnish from the metering roller; and a rubber blanket cylinder which is brought into contact with a downstream side of the form roller and is rotated in a direction opposite to that of the form roller to allow transfer of the varnish from the form roller, the rubber blanket cylinder having a notch on its outer peripheral portion and transferring the varnish onto a sheet which is in contact with its peripheral surface. The surface of the metering roller is formed of an elastic material having a roughened surface.

7 Claims, 3 Drawing Sheets



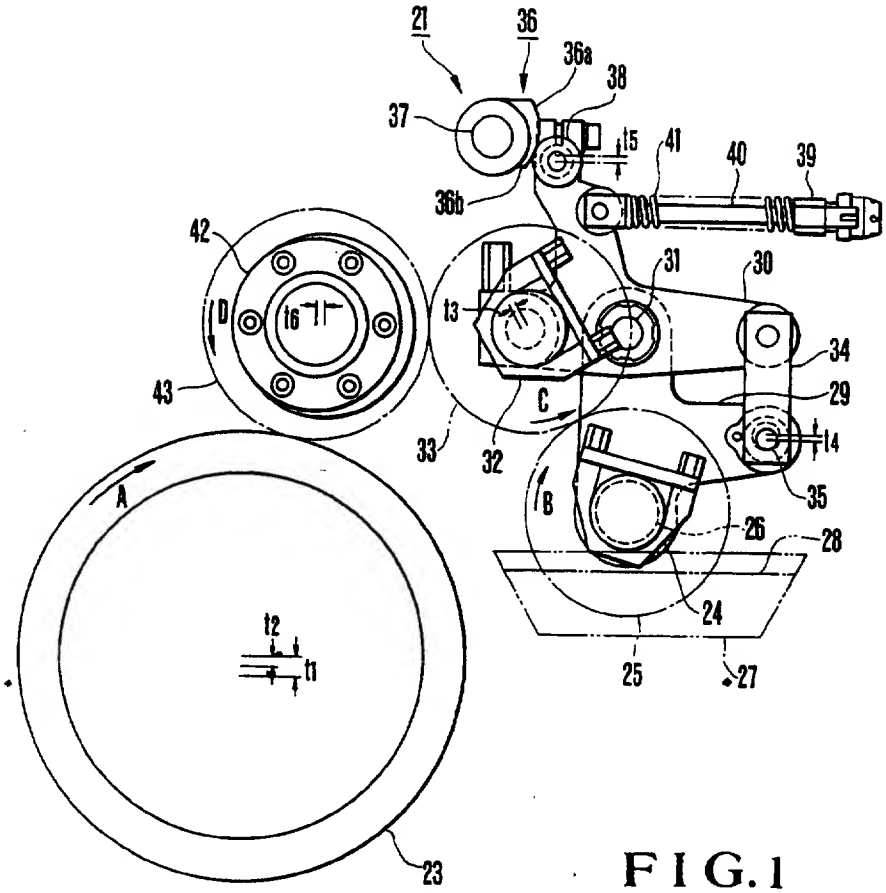

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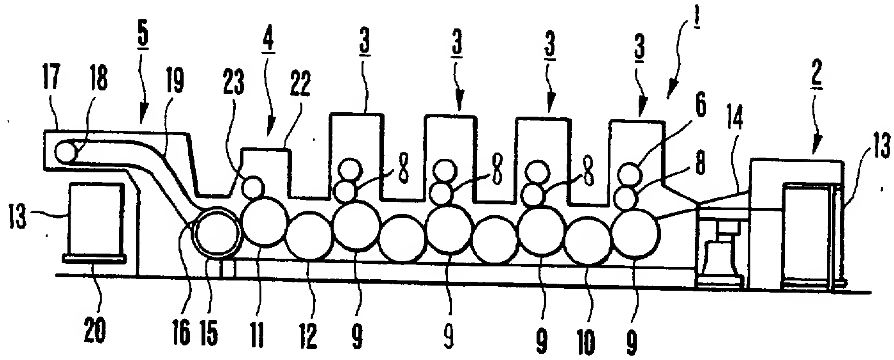
FIG.1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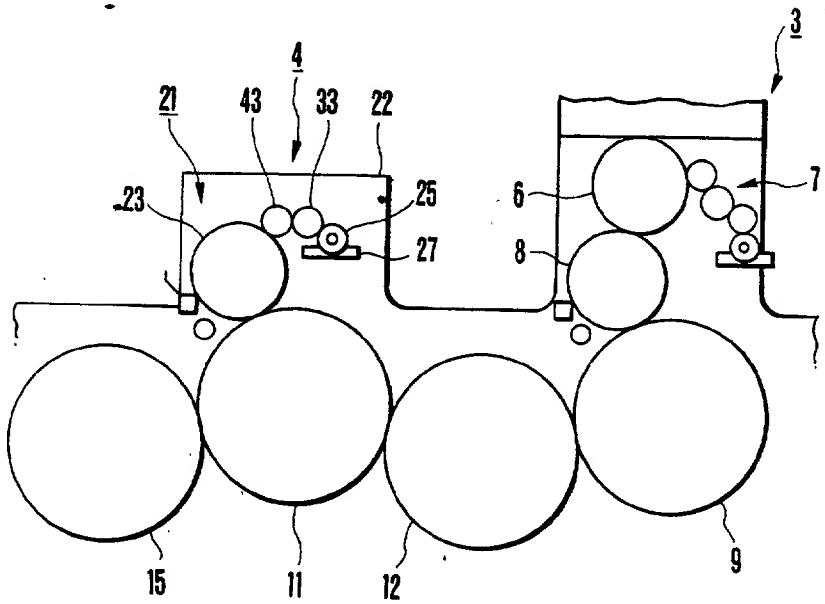
F I G.2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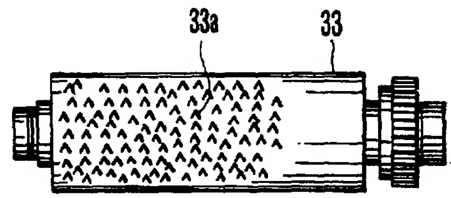

FIG.4

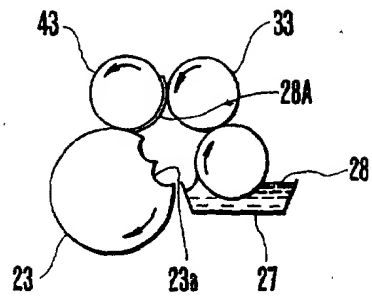

FIG.5(a)

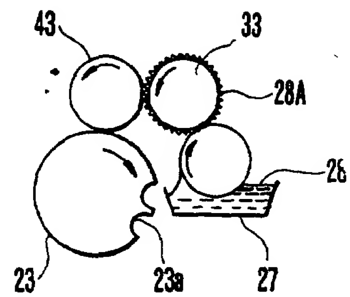

FIG.5(b)

VARNISHING APPARATUS FOR PRINTED SHEET

BACKGROUND OF THE INVENTION

The present invention relates to a varnishing apparatus, arranged between a printing unit and a delivery unit of a rotary press, or in an independent varnishing machine, for varnishing a printed surface of a paper sheet after printing.

A printed surface of a sheet printed by a rotary press is easily contaminated with ink in the following process since the ink dries slowly. In the case of sheets, offset occurs while they are stacked after a delivery operation. In order to prevent this, a drying device can be arranged midway along a conveying path of the printed sheet or spray powder can be sprayed at this position. However, the drying device makes the entire apparatus bulky. On the other hand, when powder is sprayed, the surface of the sheet is roughened causing it to lose its gloss and this often interferes with the following printing. Alternatively, varnish is coated on the printed surface to prevent it from being contaminated and to put a gloss thereon. This is performed mainly for catalogs, pamphlets, and the like, which must have a good appearance.

The varnishing apparatus of this type is sometimes used as an independent varnishing machine. However, in recent years, due to poor work efficiency caused by, e.g., re-stacking of sheets, the varnishing apparatus is normally arranged midway along a delivery path of a rotary press. A typical varnishing apparatus includes a roller group having a roller arrangement similar to that of a dampening device for supplying dampening water to the surface of a printing plate mounted on a plate cylinder of a rotary press. Varnish contained in a varnish duct is supplied to the surface of a rubber blanket cylinder through the roller group, and the varnish is transferred from the rubber blanket cylinder to a sheet passing between the rubber blanket cylinder and an impression cylinder.

However, the rubber blanket cylinder of varnishing apparatus of this type has a notch on its outer periphery portion and the notch corresponds to that for grippers of the impression cylinder. Therefore, a portion, which corresponds to the notch, of varnish to be transferred from the upstream form roller to the rubber blanket cylinder, cannot be transferred and is left on the peripheral surface of the form roller as a thick varnish film. The thick varnish film is moved to the effective surface of the rubber blanket cylinder upon the next rotation, and is then coated on a sheet. Therefore, the varnish film cannot be uniformly coated on the sheet surface between the gripper end and the sheet end, resulting in irregular density in the circumferential direction of a sheet and degrading a product quality.

SUMMARY OF THE INVENTION

It is a principal object of the present invention to provide a varnishing apparatus which can form a uniform varnish film on a rubber blanket cylinder.

It is another object of the present invention to provide a varnishing apparatus which can supply an appropriate amount of varnish, so that a thick varnish film will not be left on a peripheral surface of a form roller.

In order to achieve the above objects, there is provided a varnishing apparatus for a -printed sheet having: a metering roller, to a peripheral surface of which a

varnish from a varnish duct is transferred a roller is brought into contact with a downstream side of the metering roller, and is rotated in the same direction as that of the metering roller to allow transfer of the varnish from the metering roller. A rubber blanket cylinder is brought into contact with a downstream side of the form roller and is rotated in a direction opposite to that of the form roller to allow transfer of the varnish from the form roller onto a peripheral surface thereof. The rubber blanket cylinder has a notch on its outer peripheral portion and transfers the varnish onto a sheet which is in contact with its peripheral surface, wherein a surface of the metering roller is formed of an elastic material having a roughened surface.

With the above arrangement, varnish transferred from a varnish duct to a metering roller is transferred to and coated on a sheet through a form roller and a rubber blanket cylinder, and varnish on the form roller facing the notch of the rubber blanket cylinder is not transferred to the rubber blanket cylinder and is left attached to the peripheral surface of the form roller to again face the peripheral surface of the metering roller. However, this varnish is pushed back and flattened by the roughened surface of the metering roller and is circulated while being held in the recessed portion of the roughened surface. Thus, almost no varnish is left on the form roller. Therefore, when the peripheral surface of the form roller faces the rubber blanket cylinder, almost no excess varnish will be transferred to the rubber blanket cylinder except for a normal transfer amount.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 to 5 show a varnishing apparatus for a printed sheet according to an embodiment of the present invention, in which:

FIG. 1 is a side view of the apparatus;

FIG. 2 is a schematic side view of a four-color sheet rotary press to which the apparatus of the present invention is applied;

FIG. 3 is an enlarged side view of the main part of FIG. 2;

FIG. 4 is a front view of a metering roller; and

FIGS. 5(*a*) and 5(*b*) are side views for explaining the operation of the rollers.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An embodiment of the present invention will now be described with reference to the accompanying drawings.

Referring to FIG. 2, a rotary press 1 includes a sheet feeder 2, four-color printing units 3, a varnishing unit 4, and a delivery unit 5. These units are separately assembled and are then combined with each other. Each printing unit 3 has a plate cylinder 6 on the peripheral surface of which a printing plate is mounted, an inking device (not shown) for supplying ink to a printing surface, and a dampening unit 7 for supplying dampening water. The plate cylinder 6 abuts against a rubber blanket cylinder 8 to which an image formed on the plate surface with ink and dampening water is transferred. Each printing unit 3 has an impression cylinder 9 having a diameter twice that of the rubber blanket cylinder 8 to be in contact therewith. In addition, a transfer cylinder 10 having the same diameter as that of the impression cylinder 9 is arranged between adjacent impression

cylinders 9 to be in contact therewith. In the varnishing unit 4, an impression cylinder 11 having the same diameter as that of the impression cylinder 9 is arranged at the same level as that of the other impression cylinders. A transfer cylinder 12 is also arranged between the impression cylinder 11 and the impression cylinder 9 for the fourth color. Sheets 13 stacked on a sheet stacker of the sheet feeder 2 are picked up by a sucker device (not shown) one by one, and are fed to a feedboard 14. Thereafter, each sheet is gripped by grippers of the impression cylinder 9 for the first color through a swing device (not shown). During a sheet conveyance the sheet is alternatively gripped by the grippers of the transfer cylinder 10 and the impression cylinder 9, with the result that images of four colors are printed thereon as the sheet passes through each pair of the rubber blanket cylinders 8 and the impression cylinders 9. Then, the sheet is gripped by the grippers of the impression cylinder 11 of the varnishing unit 4 and is wound therearound. The delivery unit 5 includes a delivery cylinder 15 contacting the impression cylinder 11 and a pair of coaxial sprockets 16. A pair of endless delivery chains 19 having a large number of delivery grippers arranged at equal intervals in the direction of travel of the sheet are looped between the sprockets 16 and sprockets 18 at the front end portions of a pair of delivery frames 17. The sheet 13 gripped by the gripper of the impression cylinder 11 is then gripped and conveyed by the grippers of the chains 19 and is released therefrom at the conveying end to be dropped and stacked on a sheet stacker 20.

The varnishing unit 4 of the press 1 with the above arrangement includes a varnishing apparatus 21 described below. More specifically, a rubber blanket cylinder 23 which has the same diameter as that of the rubber blanket cylinder 8 and around which a blanket is wound is axially supported by right and left frames 22 through double-structured bearings (not shown). The rubber blanket cylinder 23 is coupled to a motor and is rotated in a direction indicated by arrow A in FIG. 1. The respective outer diameter central axes of double-structured bearings for axially supporting the rubber blanket cylinder 23 are eccentrical with that of the rubber blanket cylinder 23, as indicated by reference symbols t_1 and t_2. When the bearings are pivoted by an air cylinder an the like, the rubber blanket cylinder 23 can be brought into contact with or removed from the impression cylinder 11, and a contacting pressure between the impression cylinder 11 and rubber blanket cylinder 23 can be adjusted.

Bearings 24 supported to extend inward from the right and left frames 22 rotatably support the two ends of a shaft 26 of a duct roller 25. The duct roller 25 is dipped in a varnish 28 in a varnish duct 27 extending between the frames 22. The duct roller 25 is driven by motor (not shown) through gears and is rotated in a direction indicated by arrow B in FIG. 1. A pair of roller arms 29 are loosely mounted on the shaft portions of the bearings 24 between the end faces of the duct roller 25 and the frames 22. An inverted T-shaped arm 30 is swingably mounted on one free end portion of each roller arm 29 through a pin 31. A bearing 32 having an eccentrical bearing portion as indicated by reference symbol t_3 is fixed to one free end portion of each T-shaped arm 30 to allow pivot adjustment. The bearings 32 pivotally support a metering roller 33 so that the peripheral surface of the metering roller 33 abuts against that of the duct roller 25. The metering roller 33

is coupled to the duct roller 25 through gears (not shown), and is rotated in a direction indicated by arrow C in FIG. 1. In addition, when the bearings are pivoted by loosening bolts, a nip pressure between the duct roller 25 and metering roller 33 can be adjusted. One roller arm 29 and one T-shaped arm 30 are coupled to each other through a lever 34 having an eccentrical portion indicated by reference symbol t_4 at its one end. When a pin 35 arranged at the eccentrical portion of the lever 34 is manually pivoted, the metering roller 33 can be brought into contact with or removed from the duct roller 25.

A surface portion 33*a* of the metering roller 33 is formed of an elastic material, e.g., synthetic rubber having a hardness of 20° or higher where "°" indicates the conventional JIS standard for hardness, and a hydrophilic and a hydrophi-lic property. The surface of the elastic material is roughened by a rotary grinder or a buff for grinding. The roughness of the roughened surface 33*a* is set to be 50 to 500% mesh in this embodiment that is, a surface roughness corresponding to a mesh of 50 to 500 lines per inch.

A cam 36 has a large diameter portion 36*a* and a small diameter portion 36*b*, and is fixed to a cam shaft 37 extending between the frames 22. The cam surface of the cam 36 is brought into contact with a roller 38 which is pivotally mounted on the free end portion of each T-shaped arm 30 to allow eccentricity adjustment, as indicated by reference symbol t_5. A stud 39 projecting from each frame 22 axially supports a spring shaft 40 which is capable of pivot adjustment and one end of which is pivotally mounted on the T-shaped arm 30. The T-shaped arm 30 receives a pivoting force from a compression coil spring 41 on the spring shaft 40 for pressing the roller 38 against the cam surface of the cam 36. When the cam shaft 37 is pivoted by an air cylinder (not shown), the metering roller 33 is brought into contact with or removed from the duct roller 25 through the cam 36, the roller 38, and the T-shaped arm 30.

An eccentric bearing 42 in which an outer diameter central axis is eccentric from the inner diameter central axis as indicated by reference symbol t_6 is arranged above the rubber blanket cylinder 23 to be axially supported by the frames 22. The eccentric bearing 42 axially supports a form roller 43 so that the peripheral surface of the form roller 43 is brought into contact with that of the rubber blanket cylinder 23. When the eccentric bearing 42 is pivoted by an air cylinder (not shown), the form roller 43 is brought into contact with or removed from the rubber blanket cylinder 23. The form roller 43 is coupled to the motor for driving the duct roller 25 through a one-way clutch and gears (neither of which are shown). The form roller 43 can be driven only by the motor to be rotated in a direction indicated by arrow D in FIG. 1.

The operation of the varnishing apparatus 21 with the above arrangement will now be described. When a varnishing operation is performed, the motor for driving the duct roller 25 is started in an impression throw-off state, and the cam 36 is pivoted by the air cylinder. Thus, the roller 38 faces the small diameter portion 36*b* of the cam 36, and the metering roller 33 is pressed against the duct roller 25 and the form roller 43 by the biasing force of the compression coil spring 41. At this time, since the eccentric bearing 42 is pivoted, the form roller 43 is located at a contact position. However, the rubber blanket cylinder 23 is located at its non-contact

position upon pivotal movement of its bearing. Therefore, the form roller 43 is separated from the rubber blanket cylinder 23. Rotation of the motor is transmitted to the duct roller 25 and the metering roller 33 through the gears, and is also transmitted to the form roller 43 through the one-way clutch and the gears. Note that the rubber blanket cylinder 23 is separated apart from the impression cylinder 11 and is stopped.

When the respective rollers are rotated, the varnish 28 in the varnish duct 27 is picked up by the duct roller 25, and is transferred to the metering roller 33 while its film thickness is adjusted by the contacting force of the metering roller 43. Thereafter, the varnish 28 is transferred to the form roller 33 and is then circulated between the metering roller 33 and duct roller 25.

When the press is rotated to feed the sheet 13 onto the feedboard 14 by the sheet feeder 2, the sheet 13 is conveyed, and the rubber blanket cylinder 8 of the printing units 3 is thrown on, thus performing four-color printing between the rubber blanket cylinders 8 and the impression cylinders 9. Thereafter, the sheet 13 is conveyed toward the varnishing unit 4. When the sheet 13 reaches the varnishing unit 4, the bearing is pivoted upon instruction from a timing generator to throw on the rubber blanket cylinder 23, so that the rubber blanket cylinder 23 is pressed against the impression cylinder 11 and the form roller 43. Therefore, the varnish circulating between the form roller 43 and duct roller 25 is transferred to the rubber blanket cylinder 23, and is transferred to and coated on the sheet 13 fed between the rubber blanket cylinder 23 and the impression cylinder 11. The varnished sheet 13 is conveyed by the delivery chains 19, and is stacked on the sheet stacker 20. In the impression throw-on state of the rubber blanket cylinder 23, rotation of the motor is kept transmitted to the form roller 43 through the one-way clutch, and the rotation of the rubber blanket cylinder 23 is also transmitted to the form roller 43 through the gears and the other one-way clutch upon throwing-on of the rubber blanket cylinder 23. In this case, since the rotating speed of the rubber blanket cylinder 23 is higher than that of the motor, the rotation is transmitted only by one one-way clutch, and the other one-way clutch is rotated idle.

After the varnishing operation, the sheet-feed operation is stopped, so that the sheet stacker 20 of the delivery unit 5 is exchanged for an empty one, or a paper size is changed, or the blanket is adjusted. Then, the rubber blanket cylinder 8 of the printing units 3 is thrown off and, at the same time, the rubber blanket cylinder 23 of the varnishing apparatus 21 is thrown off with respect to the impression cylinder 11 and the form roller 43. At this time, although the metering roller 33 is kept rotated so as not to solidify the varnish, the explanation of this operation is omitted.

After the above operation or adjustment, the sheet-feed operation is restarted. When the sheet 13 reaches the rubber blanket cylinder 23, the air cylinder is operated at a predetermined timing upon instruction from the timing generator. Then, the roller 38 is pressed against the large diameter portion 36*a* of the cam 36, and the rubber blanket cylinder 23 is thrown on. Therefore, the form roller 43 is urged against the rubber blanket cylinder 23 at a contacting pressure determined by the cam 36 and the roller 38, and is recovered to a varnishing state before the sheet-feed operation is stopped.

In the varnishing apparatus 21 operated as described above, a notch 23*a* as an ineffective portion corresponding to each of the notches for the grippers of the impression cylinder 11 is formed on the outer peripheral surface of the rubber blanket cylinder 23, as shown in FIG. 5(*a*). By the way, the impression cylinder is twice as large in diameter as the blanket cylinder and is provided with two notches located at diametrically opposite positions. When the rubber blanket cylinder 23 and the form roller 43 are rotated in the directions respectively indicated by arrows A and D, the varnish corresponding to the notch 23*a* is mixed with a new varnish film without being transferred to the rubber blanket cylinder 23 and becomes a thick varnish film 28A. Thus, the varnish film 28A is left on the form roller 43 and passes through the contacting point with the metering roller 33. In this case, in the conventional apparatus described previously, the thick varnish film 28A is left on the form roller 43 and is then transferred to the peripheral surface of the rubber blanket cylinder 23 during the next rotation, thus causing uneven coating. However, in the apparatus of this embodiment, the metering roller 33 and the form roller 43 are rotated in the same direction, and the surface portion 33*a* of the metering roller 33 is roughened, as shown in FIGS. 4 and 5(*b*). Therefore, the thick varnish film 28A to be left on the form roller 43 is pushed backward and flattened by the roughened surface portion 33*a* of the metering roller 33 which is circulated while being in sliding contact with the form roller 43. In addition, since the varnish becomes attached to the metering roller 33 to be held in the recess portion of the roughened surface, it will not be left on the form roller 43. The varnish film 28A returned to the metering roller 33 merges with the varnish 28 picked up by the duct roller 25 and the film thickness is adjusted by the nip pressure therebetween.

Note that the number of rollers and the arrangement thereof are not limited to those in the above embodiment. The metering roller, the form roller, and the rubber blanket cylinder need only be brought into contact with each other in this order from the upstream side, and the number of other rollers and the arrangement thereof can be desirably determined. In the above embodiment, the case has been exemplified wherein the varnishing apparatus is installed in the four-color press. However, the present invention can be applied to any color press or can be independently used.

According to the present invention as described above, in a varnishing apparatus for a printed sheet, a metering roller, a form roller, and a rubber blanket cylinder having a notch on its outer peripheral surface are arranged in this order from a varnish duct, so that their outer peripheral surfaces are brought into contact with each other. The form roller and the rubber blanket cylinder are rotated in opposite directions to sequentially transfer a varnish from the varnish duct. Thereafter, the varnish is transferred to and coated on a sheet contacting the rubber blanket cylinder. Since the surface portion of the metering roller is formed by an elastic material having a roughened surface, when the varnish is transferred between the form roller and the rubber blanket cylinder, the varnish corresponding to the notch of the rubber blanket cylinder is left on the form roller without being transferred to the rubber blanket cylinder. Therefore, even if the varnish left on the form roller is circulated toward the contacting point with the metering roller, it is flattened and pushed back by the metering roller having the roughened peripheral surface and is held in the recess portion of the roughened surface to be left on the metering roller. Therefore,

since virtually no varnish is left on the form roller and a fresh film of varnish is supplied to the form roller from the metering roller, uneven coating will not occur on the varnished surface of a printed sheet. In addition, since the varnish can be coated uniformly, product quality of the printed sheet can be greatly improved.

What is claimed is:

1. A varnishing apparatus for a printed sheet comprising:

a varnish duct for containing a varnish;

a metering roller having a roughened peripheral surface portion roughened peripheral surface portion being formed of an elastic material;

transfer means located between said varnish duct and said metering roller for selectively transferring said varnish from said varnish duct to said roughened peripheral surface portion of said metering roller;

a form roller which is selectively in contact with said metering roller, said form roller having a peripheral outer surface, said form roller being rotated in said first direction to allow transfer of said varnish from said roughened peripheral surface of said metering roller to said peripheral outer surface of said form roller;

a rubber blanket cylinder which is selectively in contact with said peripheral outer surface of said form roller, said rubber blanket cylinder having an outer peripheral surface, said rubber blanket cylinder being rotated in a direction opposite said first direction to allow transfer of said varnish from said peripheral outer surface of said form roller onto said outer peripheral surface of said rubber blanket cylinder, said rubber blanket cylinder transferring said varnish onto said printed sheet when said printed sheet is in selective contact with said outer peripheral surface of said rubber blanket cylinder;

means adjacent said metering roller for rotating said metering roller;

means adjacent said form roller for rotating said form roller; and

means adjacent said rubber blanket cylinder for rotating said rubber blanket cylinder.

2. An apparatus according to claim 1, wherein said elastic material is synthetic rubber having a hardness of not less than 20° and a hydrophilic property.

3. An apparatus according to claim 1, wherein said roughened peripheral surface of said metering roller is formed by a rotary grinder disk.

4. An apparatus according to claim 3, wherein said roughened peripheral surface of said metering roller has a roughness of 50 to 500 lines per inch.

5. An apparatus according to claim 4, wherein said varnishing apparatus is connected to a four-color rotary press and said printed sheet is provided by said four-color rotary press.

6. An apparatus according to claim 1, wherein said roughened peripheral surface is formed by buffing.

7. An apparatus according to claim 1, wherein said means for rotating said metering roller includes means for selectively transferring said varnish from said peripheral outer surface of said form roller to said outer peripheral surface of said rubber blanket cylinder.

* * * * *

48

United States Patent [19]

Terasaka et al.

[11] **Patent Number: 4,852,515**

[45] **Date of Patent: Aug. 1, 1989**

[54] **DEVICE FOR AUTOMATICALLY CONTROLLING COATING AMOUNT FOR USE IN COATING MACHINE**

[75] Inventors: **Yoshiyasu Terasaka**, Ibaraki; **Masao Tanabe**, Osaka, both of Japan

[73] Assignee: **Chugai Ro Co, Ltd.**, Japan

[21] Appl. No.: **875,624**

[22] Filed: **Jun. 18, 1986**

Related U.S. Application Data

[63] Continuation of Ser. No. 610,691, May 16, 1984, abandoned.

[30] **Foreign Application Priority Data**

May 25, 1983 [JP] Japan 58-93247

[51] **Int. Cl.**[4] **B05C 11/00**

[52] **U.S. Cl.** **118/663**; 118/262; 72/16; 100/47

[58] **Field of Search** 118/663, 262; 101/247; 100/47, 50; 72/16, 18

[56] **References Cited**

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Primary Examiner—Shrive Beck
Assistant Examiner—Alain Bashore
Attorney, Agent, or Firm—Jackson & Jones

[57] **ABSTRACT**

A device for automatically controlling coating amount for use in a coating machine including a backup roll, an applicator roll, a pickup roll, a base, a first table slidably mounted on the base and a second table slidably mounted on the first table. The device includes first and second pressure adjusting mechanisms for adjusting a pressure between the backup roll and the applicator roll and a pressure between the applicator roll and the pickup roll. Each of the first and second pressure adjusting mechanisms further includes a sensor, a stepping motor and a precision ball bearing screw member.

13 Claims, 4 Drawing Sheets

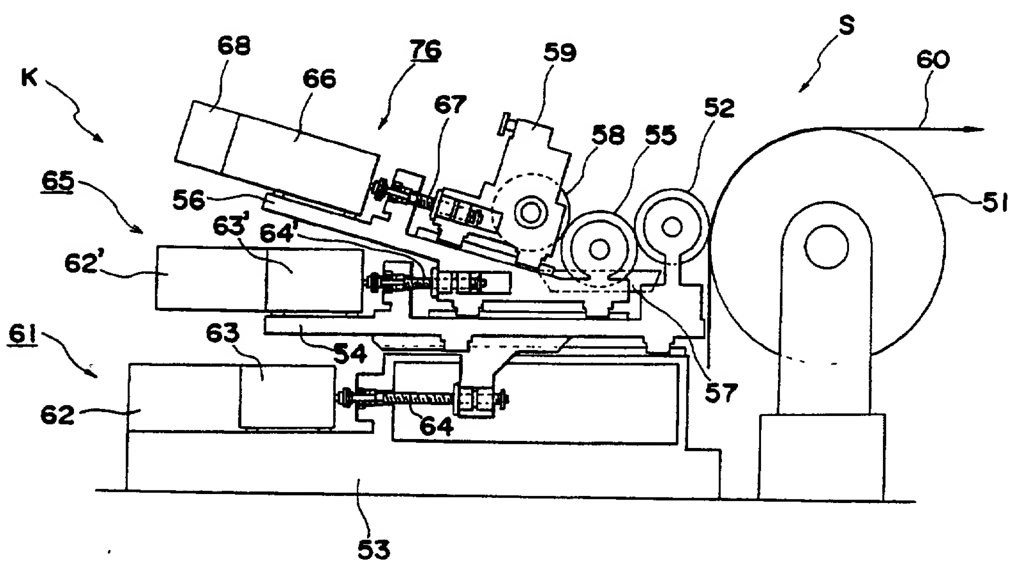


Fig. 1 PRIOR ART

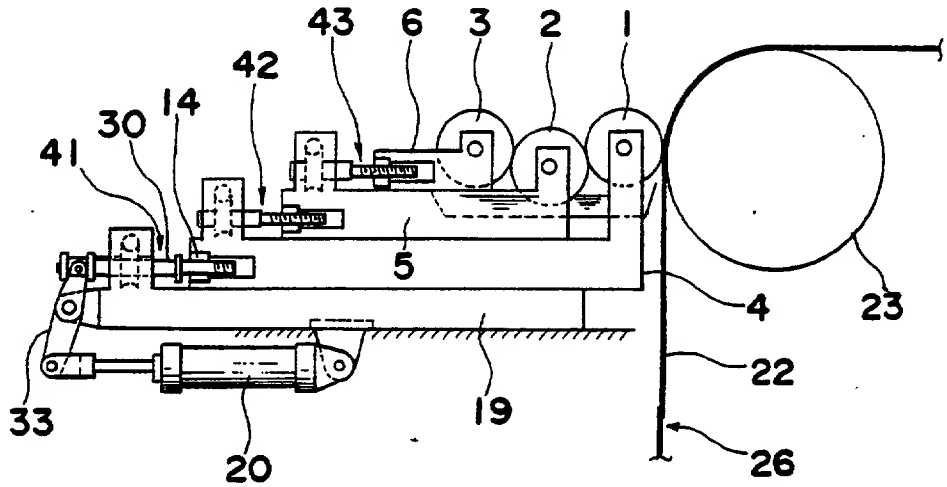
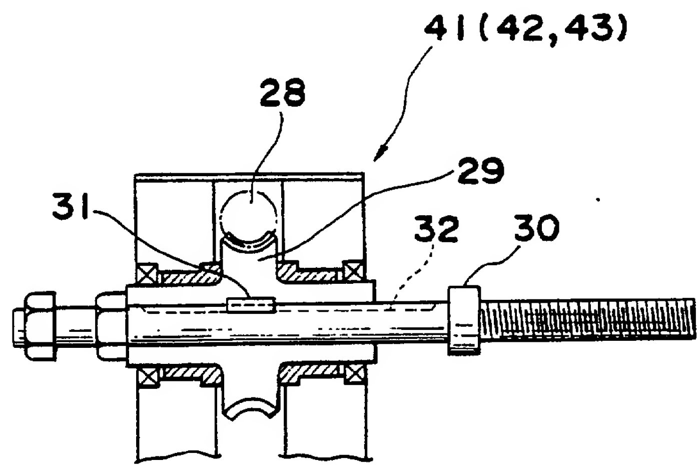


Fig. 2 PRIOR ART



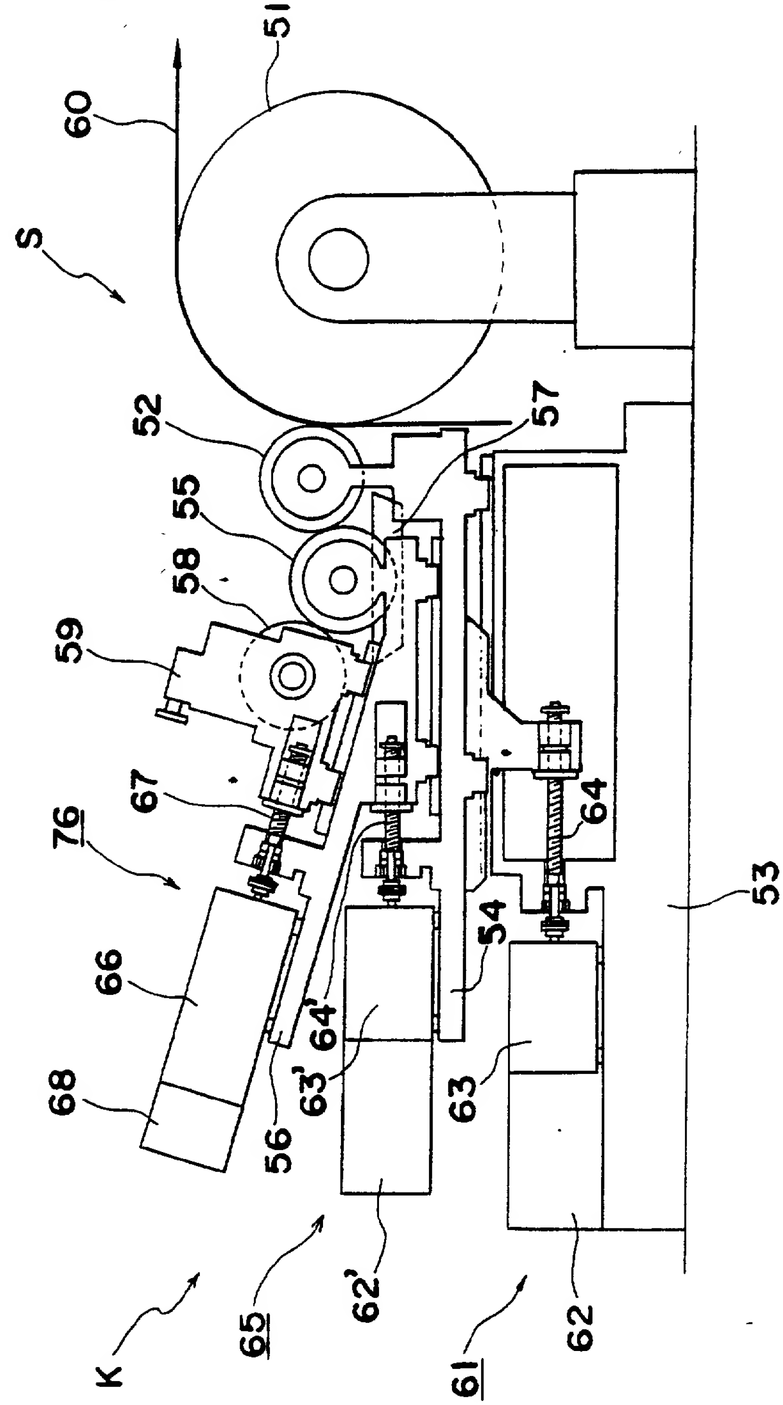


Fig. 3

Fig. 4

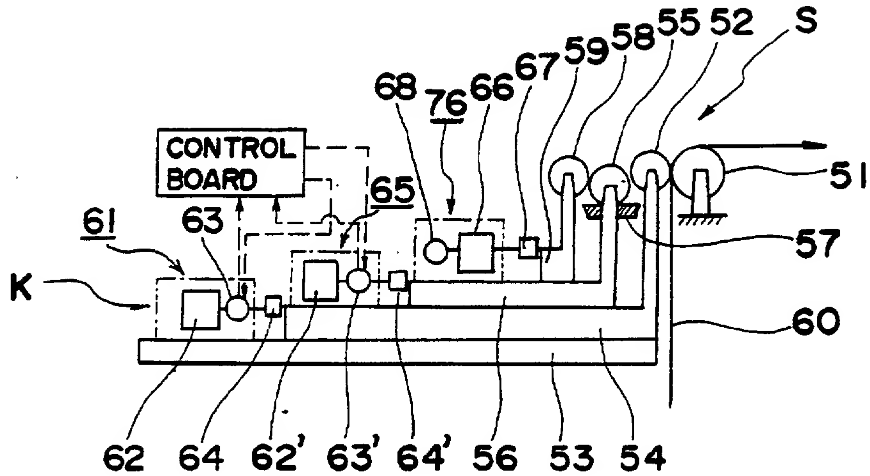

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Fig. 5

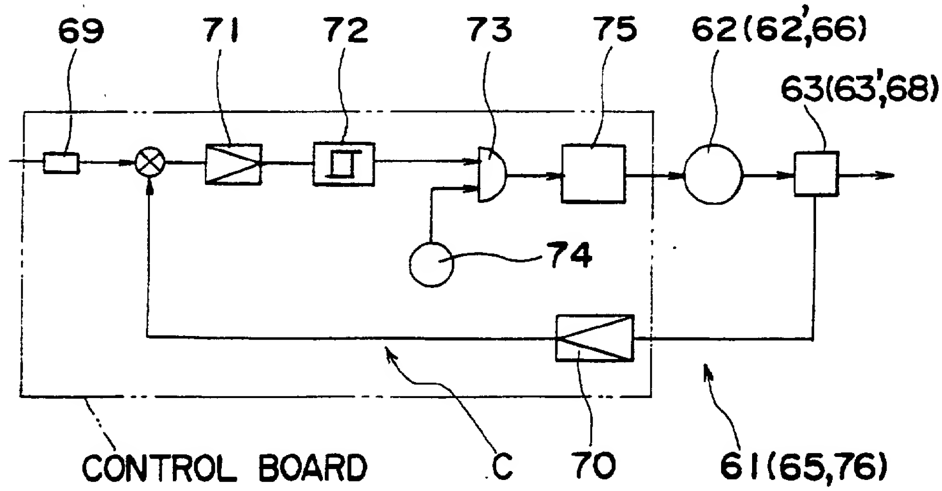
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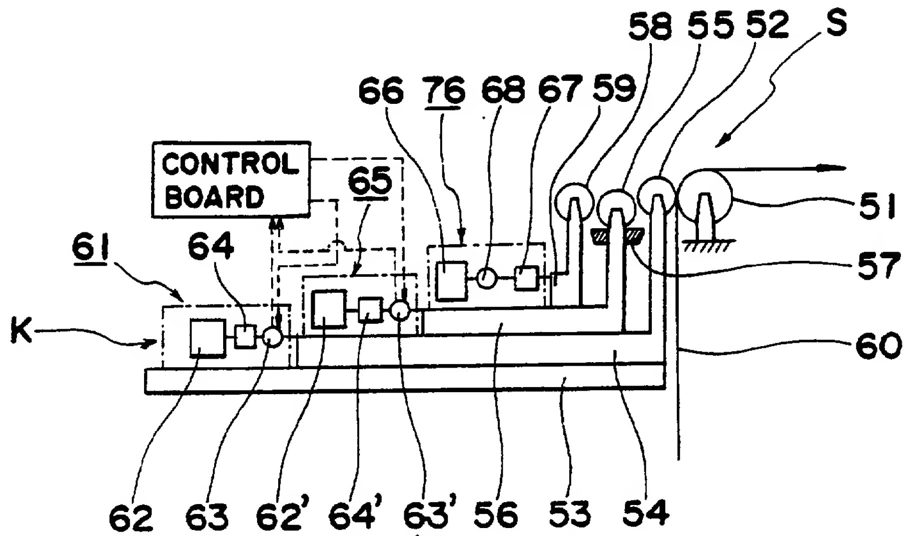
Fig. 6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DEVICE FOR AUTOMATICALLY CONTROLLING COATING AMOUNT FOR USE IN COATING MACHINE

This is a continuation of application Ser. No. 610,691, filed May 16, 1984, now abandoned.

BACKGROUND OF THE INVENTION

The present invention generally relates to a coating machine and more particularly, to a device for automatically controlling coating amount for use in the coating machine.

As shown in FIGS. 1 and 2, conventionally, in coating machines, it has been so arranged as disclosed, for example, in Japanese Laid-Open Utility Model Application No. 131869/1982 (Jikkaisho 57-131869) that an applicator roll 1 for applying paint to a sheet-like workpiece 22 pressed onto a backup roll 23 is secured to a first table 4. A pickup roll 2 for picking up paint stored in a pickup pan is secured to a second table 5, while a metering roll 3 is secured to a third table 6. The first table 4, the second table 5 and the third table 6 are slidably mounted on a base 19. Furthermore a first pressure adjusting mechanism 41 adjusts the contact pressure between the backup roll 23 and the applicator roll 1 by moving the first table 4 relative to the base 19. Mechanism 41 is mounted on the base 19 and engages the first table 4. A second pressure adjusting mechanism 42 adjusts the contact pressure between the applicator roll 1 and the pickup roll 2 by moving the second table 5 relative to the first table 4. Mechanism 42 is mounted on the first table 4 and engage the second table 5. A third pressure adjusting mechanism 43 adjust a contact pressure between the pickup roll 2 and the metering roll 3 by moving the third table 6 relative to the second table 5. Mechanism 43 is mounted on the second table 5 and engages the third table 6. Thus, thickness of a coating film on the workpiece 22 can be adjusted by operating the first, second and third pressure adjusting mechanisms 41, 42 and 43.

It should be understood that the applicator roll 1 is required to be quickly retracted away from the backup roll 23 just before a seam 26 of the workpiece 22 passes therebetween. To this end, a cylinder 20 is attached to the base 19 and is coupled with the first pressure adjusting mechanism 41 through a lever 33. Just before the seam 26 of the workpiece 22 passes between the backup roll 23 and the applicator roll 1, the first table 4 is quickly moved relative to the base 19 by the cylinder 20 in the leftward direction in FIG. 1, whereby the applicator roll 1 is quickly retracted away from the backup roll 23.

As best shown in FIG. 2, each of the first and second pressure adjusting mechanisms 41, 42 and 43 comprises a worm gearing composed of a worm 28 and a worm wheel 29, a rotary device (not shown) such as a hydraulic motor, a DC motor, etc. for driving the worm 28, a screw shaft 30 and a nut 14 (FIG. 1). The screw shaft 30 is unrotatably but axially movably mounted in the worm wheel 29 by a key 31 fitted into a key way 32 of the screw shaft 30 and is attached, at one end thereof, to the level 33. The first, second pressure adjusting mechanisms and the 41, 42 and 43 are operated by means of a manual handle based on skill of an operator. Thus, the prior art pressure and adjusting mechanisms have the disadvantages that skill of the operator is required for the operation and it is impossible to maintain each of the pressures between adjacent ones of the backup roll, the applicator roll, the pickup roll and the metering roll and the pickup roll at predetermined pressure values. Furthermore, the known pressure and adjusting mechanisms have such inconveniences that it is extremely difficult to operate them at higher speed and make them larger in size. Meanwhile, the known pressure adjusting mechanisms have been disadvantageous in that it is impossible to cope with minute changes in each pressure and the clearance due to rotation, swell, etc. of each roll. Moreover, the prior art pressure adjusting mechanisms have such a disadvantage that, in case each of the first, second and third tables are driven by a hydraulic motor or a DC motor through the worm gearing having a considerable play, it is impossible to accurately control each of contact pressures between adjacent ones of the rolls in forward and reverse rotations of the worm gearing. In addition, the known pressure adjusting mechanisms have such an inconvenience that, when a restrictive torque is continuously generated in the DC motor, its commutator is heated, thereby resulting in seizing thereof.

SUMMARY OF THE INVENTION

Accordingly, an essential object of the present invention is to provide an improved device for automatically controlling coating amount for use in a coating machine, in which each of contact pressures between adjacent rolls is detected as a detection signal, by a pressure sensor. The sensed pressure of each pair is compared with a preset value and then, a stepping motor is rotated forwardly or reversely through a step angle on the basis of a comparison signal which indicates the difference between the detection signal detected by the sensor and the present value such that each roll is moved toward or away from a corresponding neighboring one of the rolls. The roll movement is accomplished by a precision ball screw upon rotation of the stepping motor, whereby contact pressures between adjacent rolls, i.e., thickness of a coating film on a workpiece can be adjusted, with substantial elimination of the disadvantages inherent in conventional adjusting mechanisms of this kind.

Another important object of the present invention is to provide an improved device of the above prescribed type which is highly reliable in actual use and can be readily incorporated into coating machines and the like at low cost.

In accomplishing these and other objects according to one preferred embodiment of the present invention, there is provided an improved device for automatically controlling coating amount for use in a coating machine including a backup roll, an applicator roll, a pickup roll for picking up paint stored in a pickup pan, a base, a first table slidably mounted on said base, and a second table slidably mounted on said first table such that said applicator roll and said pickup roll are, respectively, secured to said first table and said second table, said device comprising: a first pressure adjusting mechanism for adjusting a contact pressure between said backup roll and said applicator roll such that said applicator roll is brought into pressing contact with said backup roll at a first preset value representing a first preset contact therebetween; and a second pressure adjusting mechanism for adjusting contact pressure between said applicator roll and said pickup roll such that said pickup roll is brought into pressing contact with said applicator roll at a second preset value representing a second preset

contact pressure therebetween; said first pressure adjusting mechanism further comprising: a first sensor for detecting a signal representing a contact pressure produced between said applicator roll and said backup roll; a first stepping motor arranged to be driven for rotation thereof in accordance with a difference between the signal detected by said first sensor and the first preset value; and a first precision ball bearing screw members for moving said first table relative to said base upon the rotation of said first stepping motor such that said applicator roll is moved toward or away from said backup roll; said second pressure adjusting mechanism further comprising: a second sensor for detecting a signal representing a contact pressure produced between said pickup roll and said applicator roll; a second stepping motor arranged to be driven for rotation thereof in accordance with a difference between the signal detected by said second sensor and the second preset value; and a second precision ball bearing screw member for moving said second table relative to said first table upon the rotation of said second stepping motor such that said pickup roll is moved toward or away from said applicator roll.

In accordance with the present invention, once the contact pressures have been set, it becomes possible to automatically adjust thickness of the coating film on the workpiece accurately by the use of the stepping motors and the precision ball bearing screw members both capable of performing forward or reverse movement through microns even if swell of the rolls takes place, and to precisely control the thickness of the coating film without shocks by varying the step advancing (or retracting) speed according to the program in case of temporary release of a seam of the workpiece to be coated.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become apparent from the following description taken in conjunction with the preferred embodiment thereof with reference to the accompanying drawings, in which:

FIG. 1 is a front elevational view of a prior art coating machine (already referred to);

FIG. 2 is a partially sectional view of a pressure adjusting mechanism employed in the prior art coating machine of FIG. 1 (already referred to);

FIG. 3 is a front elevational view of a coating machine in which a device for automatically controlling coating amount according to the present invention is incorporated;

FIG. 4 is a schematic view of the coating machine of FIG. 3;

FIG. 5 is a control circuit diagram of the device of FIG. 3; and

FIG. 6 is a view similar to FIG. 4, particularly showing a modification thereof.

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout several views of the accompanying drawings.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, there is shown in FIGS. 3 and 4, a coating machine S in which a device K for automatically controlling coating amount according to the present invention is incorporated. The coating machine S generally includes a backup roll 51, an applicator roll 52 made of elastic material such as rubber, a pickup roll 55 for picking up paint stored in a pickup pan 57, a metering roll 58, a base 53, a first table 54 slidably mounted on the base 53, a second table 56 slidably mounted on the first table 54, and a third table 59 slidably mounted on the second table 56 such that the applicator roll 52, the pickup roll 55 and the metering roll 58 are, respectively, secured to the first table 54, the second table 56 and the third table 59, with a sheet-like workpiece 60 subjected to coating being passed between the backup roll 51 and the applicator roll 52. It is to be noted that such an arrangement of the coating machine S is already known and each of the backup roll 51, the applicator roll 52, the pickup roll 55 and the metering roll 58 is driven by a hydraulic motor or a DC (or AC) motor (not shown).

Meanwhile, the device K of the present invention includes a first pressure adjusting mechanism 61 for adjusting a contact pressure between the backup roll 51 and the applicator roll 52, a second pressure adjusting mechanism 65 for adjusting contact pressure between the applicator roll 52 and the pickup roll 55 and a control board to be described later. The first clearance pressure mechanism 61 is arranged to move the first table 54 relative to the base 53 such that the applicator roll 52 is brought into pressing contact with the backup roll 51. Likewise, the second pressure adjusting mechanism 65 is arranged to move the second table 56 relative to the first table 54 such that the pickup roll 55 is brought into pressing contact with the applicator roll 52. More specifically, the first pressure adjusting mechanism 61 includes a stepping motor 62, a sensor 63 and a precision ball bearing screw member 64. The sensor 63 may be of any known contact pressure type. The stepping motor 62 and the contact pressure sensor 63 coupled to the stepping motor 62 are mounted on the base 53, while the precision ball bearing screw member 64 is mounted on the first table 54 so as to be coupled to the stepping motor 62 through the sensor 63. It is so arranged that the first table 54 is moved relative to the base 53 by the precision ball screw member 64 upon rotation of the stepping motor 62 such that the applicator roll 52 is moved toward or away from the backup roll 51. The sensor 63 and the precision ball bearing screw member 64 are operatively associated with the control board and can be exchanged, in position, with each other as shown in FIGS. 4 and 6. In the same manner as the first pressure adjusting mechanism 61, the second pressure adjusting mechanism 65 includes a stepping motor 62', a contact pressure 63' and a precision ball bearing screw member 64'. The stepping motor 62' and the sensor 63' coupled to the stepping motor 62' are mounted on the first table 54, while the precision ball bearing screw member 64' is mounted on the second table 56 so as to be coupled to the stepping motor 62' through the sensor 63'. It is so arranged that the second table 56 is moved relative to the first table 54 by the precision ball screw 64' upon rotation of the stepping motor 62' such that the pickup roll 55 is moved toward or away from the applicator roll 52. The sensor 63' and the precision ball bearing screw member 64' are operatively associated with the control board and can be exchanged, in position, with each other as shown in FIGS. 4 and 6.

The device K further includes a third pressure adjusting mechanism 76 for adjusting a third pressure between the pickup roll 55 and the metering roll 58. The third

pressure adjusting mechanism 76 is arranged to move the third table 59 relative to the second table 56 such that the metering roll 58 is brought into a pressure relative the pickup roll 55. The third pressure adjusting mechanism 76 includes a stepping motor 66, a precision ball bearing screw member 67 and a sensor 68, for instance, a roll clearance sensor. The stepping motor 66 and the sensor 68 composed of, for example, a pulse encoder coupled to the stepping motor 66 are mounted on the second table 56, while the precision ball bearing screw member 67 is mounted on the third table 59 so as to be coupled to the sensor 68 through the stepping motor 66. The stepping motor 66 and the sensor 68 can be exchanged, in position, with each other as shown in FIGS. 4 and 6. It is so arranged that the third table 59 is moved relative to the second table 56 by the precision ball bearing screw member 67 upon the rotation of the stepping motor 66 such that the metering roll 58 is moved toward or away from the pickup roll 55. The clearance between the two controls the coating thickness being applied to material 60. It is to be noted that the precision ball bearing screw members 64, 64' and 67 are arranged to directly move, upon rotation thereof, the first, second and third tables 54, 56 and 59, respectively and, for example, NSK precision ball bearing screw members (name used in trade and manufactured by Nippon Seiko K.K., Japan) can be employed therefor.

Meanwhile, as shown in FIG. 5, the control board includes a pair of control circuits C connected to the first pressure adjusting mechanism 61 and the second pressure adjusting mechanism 65, respectively. Namely, when a preset contact pressure to be applied from the applicator roll 52, through the workpiece 60, to the backup roll 51 has been given to a presetter 69 as a preset signal in the first pressure adjusting mechanism 61, a contact pressure applied from the applicator roll 52 to the backup roll 51 is detected as a reaction force of elastic material of the applicator roll 52 and thus, a contact pressure between the applicator roll 52 and the backup roll 51 is detected through the precision ball bearing screw member 64 by the sensor 63. This detection signal of the sensor 63 is transmitted via an amplifier 70 for the sensor 63 so as to be compared with the preset signal from the presetter 69 and then, is applied to a comparator circuit 72 by way of a preamplifier 71. In the case where a difference between the detection signal of the sensor 63 and the preset signal from the presetter 69 exceeds a predetermined value, a comparator signal is delivered from the comparator circuit 72 and then, the gate circuit 73 is opened, so that a pulse signal is inputted to a driver unit 75 on the basis of a frequency of an oscillator 74 connected to the gate circuit 73, the frequency being varied by a preset program. Thus, the stepping motor 62 is rotated forwardly or reversely at a given programmed speed through a predetermined angle by a power signal from the drive unit 75. Upon the rotation of the stepping motor 62, the first table 54 is moved relative to the base 53 by the precision ball bearing screw member 64 such that the applicator roll 52 is moved toward or away from the backup roll 51. Subsequently, a signal indicating a change in contact pressure between the backup roll 51 and the applicator roll 52 due to movement of the applicator roll 52 toward or away from the backup roll 51 is again fed back to the control circuit C such that the applicator roll 52 is brought into pressing contact with the backup roll 51 automatically at a preset value based on the contact pressure. Consequently, the backup roll 51 and the applicator roll 52 are maintained at the preset contact pressure therebetween.

Furthermore, if a change in a roll diameter due to replacement of the applicator roll 52, etc. causes difference in the amount of movement between the tables, the pressure between the rolls, when the sensor 63 detects the given contact pressure, is automatically memorized and is designated as an original point of the pressure. Thus, the relation in respect of coating conditions is always kept if the movement is repeated.

Adjustments between the applicator roll 52 and the pickup roll 55 and between the pickup roll 55 and the metering roll 58 are performed in the same manner as described above.

In the event that the coating operation of the coating machine S is started or stopped by moving the first table 54 or that a seam of the workpiece 60 to be coated is temporarily advanced or retracted for cleaning, the roll (contact pressure) between the applicator roll 52 and the backup roll 51 is adjusted by the first pressure adjusting mechanism 61 by moving the first table 54 at said programmed speed.

The second table 56 and the third table 59 are also moved in the same manner as the above described first table 54.

As is clear from the foregoing description, in accordance with the present invention, the contact pressure applied from the applicator roll to the backup roll, the contact pressure applied from the pickup roll to the applicator roll and the pressure between metering roll and the pickup roll is detected by the appropriate sensors. Thereafter, this is compared with the preset value such that the precision ball bearing screw member is driven through the stepping motor, so that the first table and/or the second table is moved relative to the base and/or the first table, whereby the coating amount on the workpiece is automatically controlled precisely.

Furthermore, in accordance with the present invention, since each of the first table and the second table is moved automatically by the use of the stepping motor and the precision ball bearing screw both free from play, it becomes possible to accurately control the thickness of the coating film on the workpiece.

Although the present invention has been fully described by way of example with reference to the accompanying drawings, it is to be noted here that various changes and modifications will be apparent to those skilled in the art. Therefore, unless otherwise such changes and modifications depart from the scope of the present invention, they should be construed as included therein.

What is claimed is:

1. A device for automatically controlling the coating amount of paint deposited on a continuous strip moving between a pair of circular rolls in a coating machine including at least three tandemly located circular rolls that are in continuous adjustable contact with the next adjacent roll in the tandem sequence, said rolls including a circular backup roll and a circular applicator roll of an elastic material with a strip to be coated moveable therebetween, a circular pickup roll in contact with said elastic applicator roll for picking up paint stored in a pickup pan, and a circular metering roll in contact with the circular pickup roll, a fixed base, a first table slidably mounted on said base, and a second table slidably mounted on said first table such that said circular applicator roll and said circular pickup roll are, respectively,

slidably secured to said first and said second table for a continuous and automatically adjustable pressure contact between all of said circular rolls, said device comprising:

a present pressure control program for automatically and continuously controlling the pressure adjustment between adjacent individual ones of said above-claimed circular rolls to lie within an equilibrium condition within a predetermined range of pressure;

means for emitting a first preset signal indicative of a desired preset contact pressure range between said circular backup roll and said circular elastic applicator roll while said strip to be coated is moved therebetween;

a first pressure adjusting mechanism coupled between said fixed base and said first table for continuously and automatically adjusting the contact pressure applied from said applicator roll through said backup roll such that said applicator roll is slidably brought into pressing elastic contact with said backup roll at a pressure lying within said predetermined equilibrium pressure range;

means for emitting a second preset signal indicative of a range of desired preset contact pressure between said applicator roll and said pickup roll;

a second pressure adjusting mechanism carried by said first table and coupled between said first and second tables for continuously and automatically adjusting the pressure between said applicator roll and said pickup roll such that said pickup roll is slidably brought in pressing contact with said applicator roll at a pressure lying within said second pressure range therebetween;

said first pressure adjusting mechanism further comprising;

a first sensor in combination with a first precision ball bearing screw member for detecting a first signal representing a contact pressure reaction force of said elastic applicator roll material produced between said applicator roll and said backup roll;

a first comparator circuit means for generating and storing said first detected signal, and means associated with said first comparator circuit for emitting a first difference signal indicative of the difference, if any, between said first preset value range and said first sensor's detected signal value;

a first stepping motor arranged to be intermittently driven through step angle rotation thereof by said first difference signal when said first sensed signal is outside said predetermined range and in accordance with said preset pressure control program;

said first precision ball bearing screw member being further adapted for moving said first table relative to said base upon the intermittent rotation of said first stepping motor such that said applicator roll is slideably moved by steps toward or away from said backup roll at a speed controlled by said preset pressure control program until said desired and controlled preset pressure is achieved within said predetermined range and the reaction force sensed by said first sensor is at a null condition that stops further rotation of said first stepping motor;

said second pressure adjusting mechanism further comprising;

a second sensor in combination with a second precision ball bearing screw member detecting a second signal representing a contact pressure reaction force of said elastic applicator roll material produced between said pickup roll and said elastic applicator roll;

a second comparison circuit means for generating and storing said second sensor's detected signal, and means associated with said second comparator circuit for emitting a second difference signal indicative of the difference, if any, between said second preset value range and said second sensor's detected value;

a second stepping motor arranged to be intermittently driven through step angle rotation thereof in accordance with said second difference signal when said second signal is outside said second predetermined range and in accordance with said preset pressure control program; and

said second precision ball bearing screw member being further adapted for moving said second table relative to said first table upon the intermittent rotation of said second stepping motor such that said pickup roll is slidably moved by steps toward or away from said applicator roll at a speed controlled by said preset pressure control program until said second desired and controlled preset pressure is achieved and said reaction force sensed by said second sensor is at a null condition that stops further rotation of said second stepping motor.

2. A device as claimed in claim 1, further including a third table slidably mounted on said second table such that said metering roll is secured to said third table.

3. A device as claimed in claim 1, wherein each of said first pressure adjusting mechanism and said second pressure adjusting mechanism further comprises a presetter for defining each of the first preset contact pressure and the second preset contact pressure, and wherein said first and second comparators include a series connected circuit having a coincidence gate and a driver unit, together with an oscillator adapted to feed driving pulses through said gate and driver unit to said stepping motor circuit when said gate circuit is in an enabled condition.

4. A device for automatically controlling coating amount for use in a coating machine including a circular backup roll mounted for rotation on a backup axle, and an elastic circular applicator roll mounted for rotation on an applicator axle, a circular pickup roll mounted for rotation on a pickup axle for picking up paint stored in a pickup pan, a base, a first table slidably mounted to move said applicator roll and its axle on said base, and a second table slidably mounted on said first table to move said pick up roll and its axle along with said second table such that said elastic applicator roll and said pickup roll are, respectively, secured to and move with said first table and with said second table, respectively, said device comprising:

a first contact adjusting mechanism for automatically and continuously adjusting a contact pressure between said backup roll and said elastic applicator roll by moving the first table, the applicator roll and its axle such that said elastic applicator roll is automatically brought into pressing contact with said backup roll at a first preset value representing a first preset contact pressure therebetween; and

a second contact adjusting and continuously mechanism moveable both on said first contact adjusting mechanism and also automatically adjustable independently from said first adjusting mechanism, for

automatically adjusting a contact pressure between said elastic applicator roll and said pickup roll by moving the pickup roll and its axle such that said pickup roll is brought into pressing contact with said applicator roll at a second preset value representing a second preset contact pressure until said elastic applicator roll is in a continuous equilibrium state between said backup and said elastic pickup rolls in the presence of swells in said rolls or a seam in said workpiece being coated while said automatic adjustment is taking place.

5. A device in accordance with claim 4 wherein said first contact adjusting mechanism further comprises:

a first sensor for detecting a first signal representing a contact pressure produced between said elastic applicator roll and said backup roll; and

a first stepping motor arranged to be driven for rotation in accordance with said difference signal between the first signal detected by said first sensor and the first preset value.

6. A device in accordance with claim 5 and further comprising:

a first precision ball screw for moving said first table relative to said base upon the rotation of said first stepping motor such that said elastic applicator roll is moved toward or away from said backup roll.

7. A device in accordance with claim 6 wherein said second contact adjusting mechanism further comprises:

a second sensor for detecting a second signal representing a contact pressure produced between said pickup roll and said elastic applicator rolls; and

a second stepping motor arranged to be driven for rotation in accordance with said difference signal between the second signal detected by said second sensor and the second preset value.

8. A device in accordance with claim 7 and further comprising:

a second precision ball bearing screw member for moving said second table relative to said first table upon the rotation of said second stepping motor such that said pickup roll is moved toward or away from said elastic applicator roll.

9. A device as claimed in claim 4 and further including:

a metering roll; and

a third table slidably mounted on said second table such that said metering roll is secured to said third table and is adjustable toward or away from said pickup roll.

10. A device as claimed in claim 9, and further comprising a third pressure adjusting mechanism, said third pressure adjusting mechanism comprising:

a third sensor for detecting a signal representing contact pressure produced between said metering roll and said pickup roll; and

a third stepping motor arranged to be driven for rotation thereof in accordance with a difference between the signal detected by said third sensor and the third preset value.

11. A device in accordance with claim 10 and further comprising:

a third precision ball bearing screw member for moving said third table relative to said second table upon the rotation of said third stepping motor such that said metering roll is moved toward or away from said pickup roll.

12. A device as claimed in claim 11 wherein each of said first and second pressure adjusting mechanisms each further comprises:

a presetter for defining each of the first preset contact pressure and the second preset contact pressure; and

wherein said first and second comparators each include a series-connected circuit having a coincidence gate and a driver unit, with an oscillator adapted to feed driving pulses through said coincidence gate and the driver unit to each of said stepping motor circuits when said coincidence gate circuit is in an enabled condition.

13. In a control device for automatically controlling the amount of paint applied to an elongated sheet having a backup roll supporting the sheet which contains an enlarged seam therein, an applicator roll for applying the paint, a pickup roll for picking up the paint stored in a pickup pan, a support base, a first table slidably mounted on said base, and a second table slidably mounted on said first table such that said applicator roll and said pickup roll are, respectively, secured to said first table and said second table, the improvement comprising:

an elasticized coating on said applicator roll with said elasticized applicator roll being positioned in tandem with said other rolls and located between said pickup and said backup rolls;

a first contact adjusting mechanism for adjusting a contact pressure between said backup roll and said elasticized applicator roll such that said applicator roll is brought into pressing contact with said backup roll at a first preset value representing a first preset contact pressure therebetween;

a second contact adjusting mechanism for adjusting a contact pressure between said elasticized applicator roll land said pickup roll such that said pickup roll is brought into pressing contact with said applicator roll at a second preset value representing a second preset contact pressure therebetween;

means for storing and generating electrical signals representative of said first and second preset contact pressure values;

said first contact adjusting mechanism further consisting of a first sensor means for producing a first signal representing the actual contact pressure between said elasticized applicator roll and said backup roll, and a first stepping motor arranged to be electrically driven for rotation thereof in accordance with a difference signal between the actual contact pressure signal detected by said first sensor and the first preset value;

a first precision member for automatically moving both said first table and said second contact adjusting mechanism relative to said base in response to said first difference signal by rotation of said first stepping motor such that said elasticized applicator roll is moved toward or away from said backup roll;

said second contact adjusting mechanism further consisting of;

a second sensor means for producing a second signal representing a contact pressure produced between said pickup roll and said elasticized applicator roll;

a second stepping motor arranged to be electrically driven for rotation thereof in accordance with a difference between the second signal detected by said second sensor and the second preset value; and

a second precision member for automatically moving said second table relative to said first table upon the rotation of said second stepping motor such that said pickup roll is moved toward or away from said elasticized applicator roll, said adjustments of the respective first and second contact adjusting mechanisms independently and automatically being implemented continuously to place all of said tandem rolls in an equilibrium state that assures a constant amount of paint being applied to the sheet in the presence of said seam in another sheet, which seam disrupts the pressure between said tandem rolls were it not for the continuous adjustment of said first and second contact adjustment mechanisms.

* * * * *

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United States Patent [19]

Koehler et al.

[11] **Patent Number:** 4,934,305

[45] **Date of Patent:** Jun. 19, 1990

[54] **RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER**

[75] Inventors: **Jamie E. Koehler**, Montreal, Canada; **James E. Taylor**, Dallas, Tex.

[73] Assignee: **Dahlgren International, Inc.**, Dallas, Tex.

[21] Appl. No.: **365,680**

[22] Filed: **Jun. 13, 1989**

[51] **Int. Cl.⁵** **B05C 1/02**

[52] **U.S. Cl.** **118/46**; 101/329

[58] **Field of Search** 118/46, 258, 262, 259; 101/329, 137, 147

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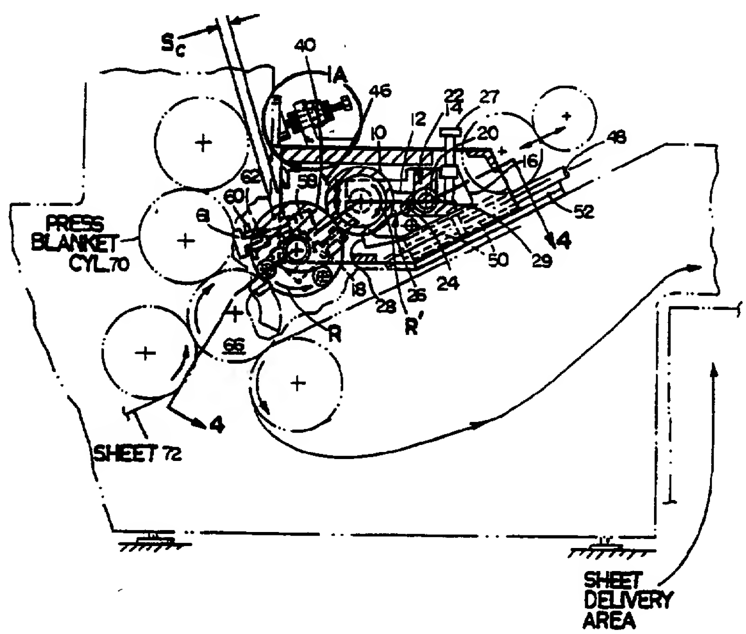
Primary Examiner—Willard Hoag

[57] **ABSTRACT**

An addition to a multi-color lithographic offset printing press comprising a self-contained coating unit moveable into and out of operative relationship with the last stage impression cylinder without interrupting or disrupting printing taking place in this last stage. The coating unit includes a special blanket cylinder, a transfer roller and doctor or metering means to control the amount of coating material on the transfer roller. Inclined tracks are provided to guide the coating unit into and out of operative relationship with the impression roller of the last printing stage.

17 Claims, 3 Drawing Sheets



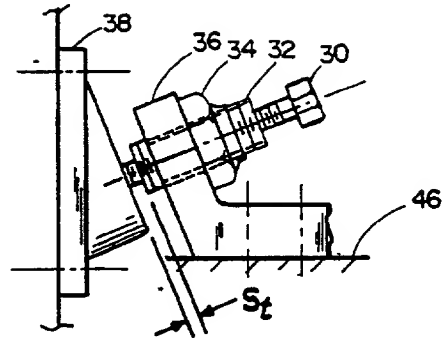

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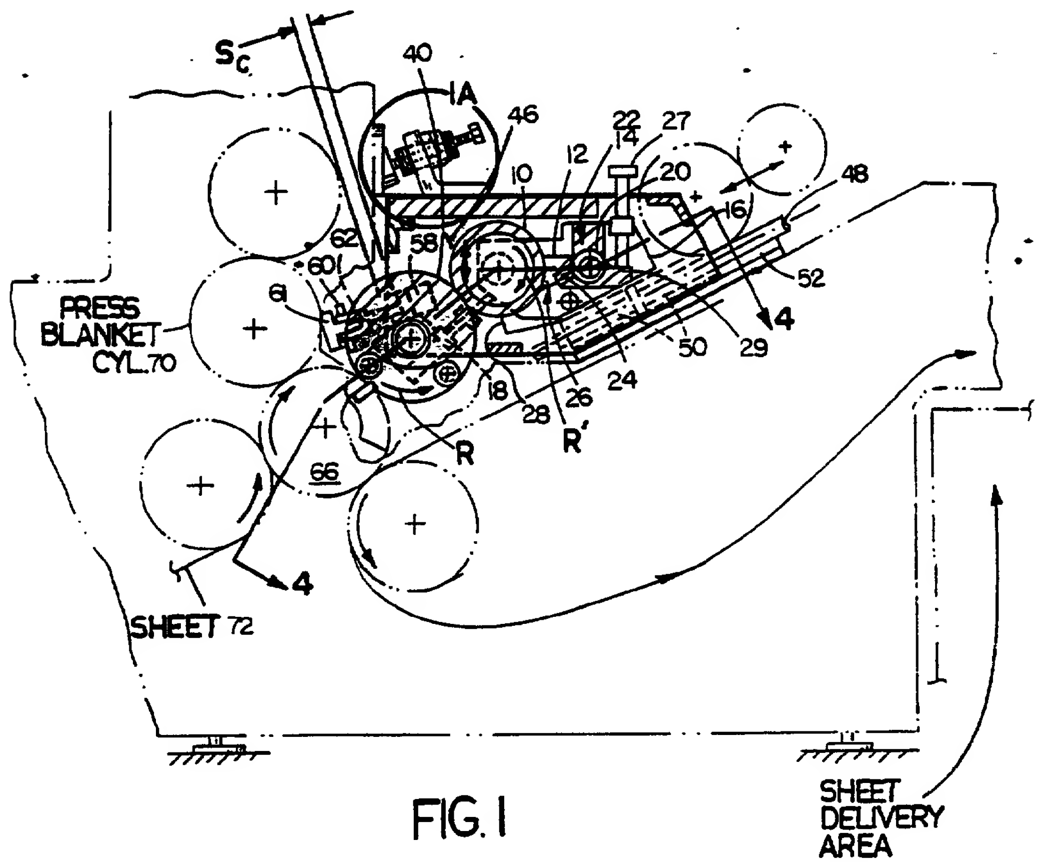
FIG. 1A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29
24
26
18
28
R
R'
66
4
SHEET 72
SHEET DELIVERY AREA

FIG. 1

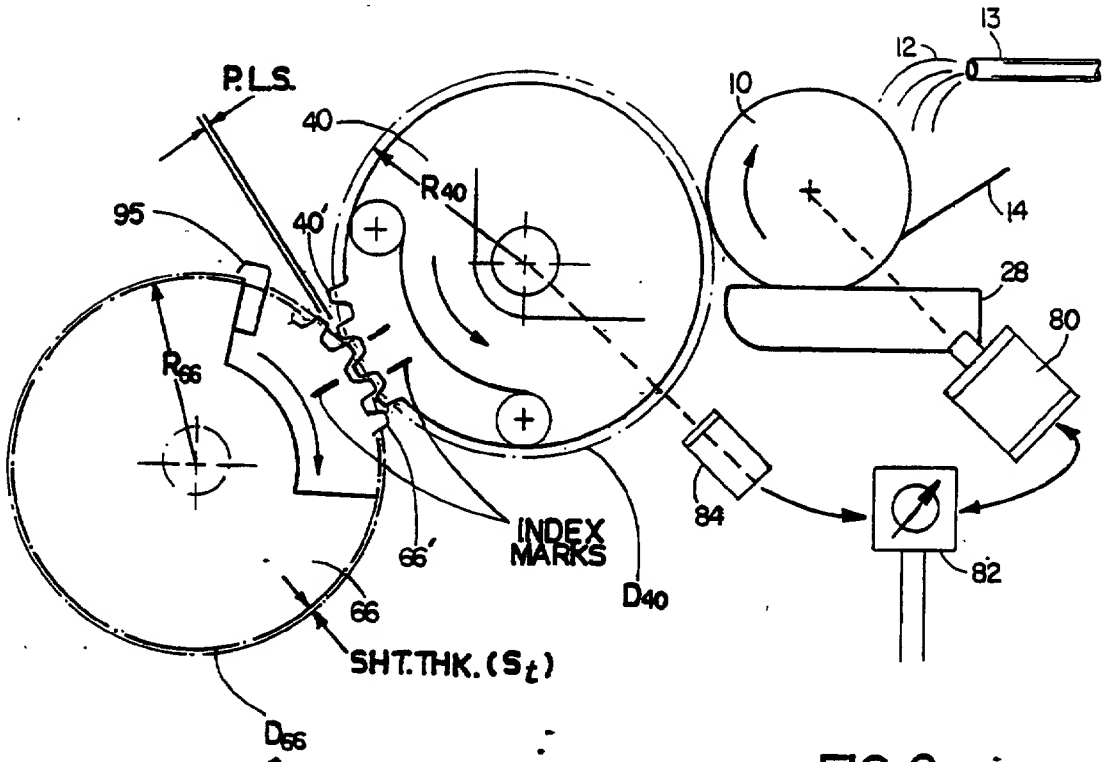
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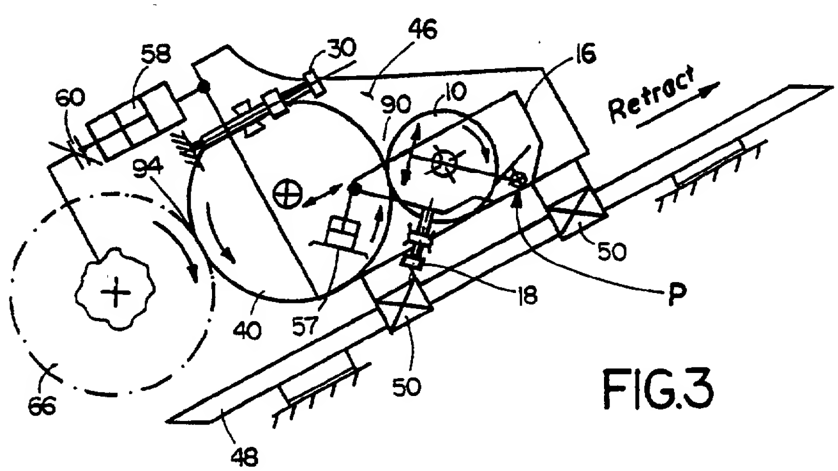
FIG. 2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P
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66
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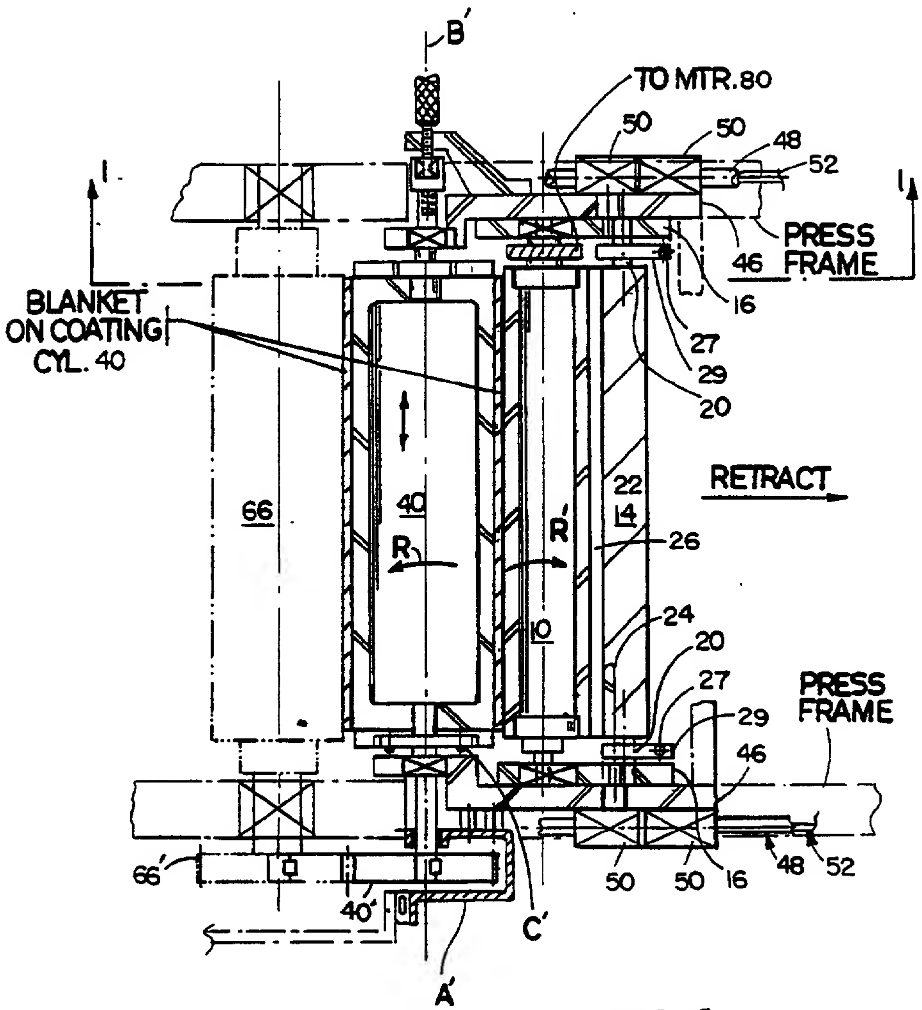
FIG. 3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22
14
66
40
R
R'
26
10
24
20
27
29
PRESS FRAME
46
66'
40'
C'
A'
50
50
16
48
52

FIG.4

RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER

BACKGROUND OF THE INVENTION

This invention relates to coating printed sheets. It more particularly refers to a process and apparatus for coating sheets which have been printed on offset printing equipment.

In many applications it is desirable to apply a spot or overall coating to a printed sheet. For example, a UV curable or water-soluble polymer finish may be applied to a workpiece printed by offset lithography. The coating on the sheet is quickly dried while the surface of the ink is still tacky. This coating avoids the need for powder driers sprayed between sheets to present offsetting of oxidation-dried inks that are slow to dry. These coatings are also useful for providing a glossy finish that improves the rub-resistance of the workpiece and improves its overall appearance and feel. Finally, adhesive coatings may be applied to printed packaging; for example, heat-set adhesives may be applied to enable attachment of a feature such as clear plastic bubble of a package used to display the product. It is said that Ultraviolet cured and aqueous overprint coatings are, by some measurements, the fastest growing segments of the printing industry.

Application of coatings to a workpiece is made difficult by various requirements. For example, the coating should be uniform and its thickness should be controlled. Moreoever, the aqueous coating should be applied quickly, before its vehicle evaporates causing it to thicken. Finally, it is desirable for the coater to operate "in line" with the press that prints the workpiece to take full advantage of the fast drying capability of coatings and generally to simplify the manufacture of printed coated workpieces.

Butler U.S. Pat. No. 4,270,483 discloses an in line coating apparatus for attachment to a conventional offset lithographic printing press. The apparatus includes a set of rollers (i.e., pick-up roller **14** and application roller **16**) to deliver coating material from a reservoir **18** to a standard press unit blanket roll **108**. A metering rod **40** meters the amount of coating transferred to application roller **16**.

An in line coater sold by Norton Burdett Co. of Nashua, N.H. has a single roller driven directly by a D.C. motor. The roller is a gravure cylinder that transfers coating to a standard press unit blanket cylinder. The coater is attached to a pivoting arm, and the unit can be pivoted away from the press unit when the coater is not in use.

Another in line coater, sold by IVT Colordry, Inc. of Fairfield, Conn., applies coating from a reservoir pan to a standard press unit blanket cylinder using a pick-up roller that delivers a coating supply to an applicator roller; the applicator roller applies the coating to the blanket cylinder of a press unit.

Kumpf U.S. Pat. No. 3,768,438 discloses a coater in which a fountain roller dips into a coating reservoir and transfers liquid coating material to a feed roller. The feed roller in turn transfers coating material to a coating roller that coats a sheet fed between the coating roller and a format roller.

Di Rico U.S. Pat. No. 4,685,414 discloses a process and apparatus for use in combination with an existing press unit wherein the coating means is retractable, to be used or not as the printer requires. In this device, the

coating means utilizes the blanket roll of the last unit of the press, and this last unit cannot be used for color application means when it is used for coating. For example in a four color press, utilizing the coating apparatus of the '414 patent would then permit only three colors to be printed in in-line, single pass operation.

Bird U.S. Pat. No. 4,796,556 discloses an offset lithographic apparatus with a plate cylinder and a blanket cylinder, and an in line coater to apply liquid coatings either in a pattern or over the entire workpiece. The apparatus has a carriage which moves the coater between a first position operative association with the plate cylinder of the lithographic press unit (see full line of unit 72 in FIG. 1) and a second position in operative association with the blanket cylinder of the lithographic press unit (see broken line of unit 72 in FIG. 1). In the first position the coater applies spot coating, and in the second position the coater applies coating over the entire sheet.

Satterwhite U.S. Pat No. 4,308,796 discloses apparatus for adapting an offset lithographic press to flexographic operations, the flexographic operation being either for coating or printing. Coating is achieved by applying a photosensitive plate to the lithographic blanket roll of the offset press. A transfer roll supplies coating to the plate. Inking is achieved in a like manner but with a flexographic plate having raised image areas.

Makosch U.S. Pat. No. 4,397,237 discloses a pivoting secondary inking system ("B" in FIG. 2).

Preuss et al. U.S. Pat. No. 3,391,791 discloses a sheet coater which moves into engagement with various cylinders in a press delivery area.

Knodel et al. U.S. Pat. No. 3,916,824 discloses a coating assembly which includes a fountain roll, a metering roll and an applicator roll for coating band of ribbon material. The coater is horizontally displaceable on an auxiliary frame.

Jahn U.S. Pat. Nos. 4,615,293 and 4,706,601 disclose separate duplex coating units disposed downstream of a printing press. The units permit coating of selected portions of the workpiece using a relief plate or permit blanket coating.

Switall U.S. Pat. No. 4,617,865 discloses a coater that can be pivoted into and out of position in contact with the blanket cylinder of the press unit; the coater being retractable with the same limits as that of the Di Rico device, i.e., the coating and printing functions cannot be performed simultaneously.

Jirousek U.S. Pat. No. 2,320,523 discloses a self-adjusting dampening roll.

Edwards U.S. Pat. No. 4,222,325 discloses a retractable dampening and inking unit.

Egnaczak U.S. Pat. 3,800,743 discloses a coater for a photoelectrophoretic process.

DeLigt U.S. Pat. No. 3,397,675 discloses a coating or printing station having its applicator and transfer rolls attached to pivotally mounted supporting frames.

Some commercial presses, such as Heidelberg GTO and MO include an extra blanket cylinder e.g., for numbering, printing extra colors, perforating, center slitting, etc. This added cylinder is a fixed part of the press, and does not retract with associated equipment for numbering or imprinting.

SUMMARY OF THE INVENTION

This invention generally features apparatus that operates on line with a sheet-fed lithographic printing press

unit to apply a liquid coating to a sheet workpiece. The apparatus includes a liquid coating supply means, a special coating blanket cylinder (in addition to the blanket cylinder of the press unit), and means for metering and transfering coating material operatively connected to the coating blanket cylinder and to the liquid coating supply means, for controlling the amount of coating supplied onto the coating blanket cylinder from the supply means. Structural members integrate the means for metering and transfering coating and the coating blanket cylinder into an independent, cooperatively operating, coating assembly. The apparatus also includes a means for positively driving the coating blanket cylinder in association with the press unit impression cylinder and mounts for guiding movement of the coating assembly between an operative position, in which the coating blanket cylinder is operatively engaged with the press unit impression cylinder, and an off imprint (or off-impression) position, in which the coating blanket cylinder and drive is slightly separated from the impression cylinder (i.e., separated sufficiently to prevent contact). In the operative position the coating blanket cylinder can be accurately adjusted relative to the impression cylinder. Moreover, the coating assembly can be actuated so the coating blanket cylinder is slightly separated from the impression cylinder. Such adjustment and actuation are achieved without a change in the coating blanket cylinder position relative to the coating metering and transfer means.

The system is especially adaptable to press types such as the Heidelberg Speedmaster line of presses, where there is access on the impression cylinder of the last press unit, between the press blanket cylinder and the sheet transfer cylinder of the delivery, to add a blanket cylinder for coating. The coating blanket cylinder is adapted to provide a coating surface, which preferably is the same basic diameter as the standard printing blanket cylinder. By "adapted to provide a coating surface", we mean that the coating blanket cylinder can receive a standard resilient blanket, or it can receive a relatively hard or resilient relief plate. Alternatively, the cylinder could have a surface with permanent relief. For spot-coating, the coating blanket cylinder carries a photopolymer relief plate. This cylinder is also preferably equipped for circumferential and lateral (side) register to enable accurate positioning of the plate. Pin register may also be supplied for pre-positioning of the plate relative to the positions of upstream printing plates. Pin-register may be supplied in lieu of, or, in conjunction with circumferential and side register means. The photopolymer plate may be installed in the same blanket reels or clamps as provided for the blanket, or, may be attached to the cylinder, independent of the blanket clamping provisions.

The coating blanket cylinder continuously delivers a smooth, uniform metered amount of liquid coating material to one position of a sheet workpiece carried on the press unit impression cylinder, while at the same time, printing is immediately being applied by the press unit blanket cylinder, prior to coating, to a different position of the sheet workpiece.

Preferred embodiments of the invention are characterized as follows. The mounts guide the coating assembly to move to a fully retracted position in which the assembly and particularly the coating blanket cylinder are completely disengaged from the press unit impression cylinder at a remote location from the press unit cylinders. The coating transfer means comprises a transfer (delivery) cylinder (e.g. an engraved or smooth cylinder) in operative contact with the coating blanket cylinder, as well as a metering means (an elongated blade or a metering roll) for metering the amount of coating carried on the transfer cylinder. The coating assembly is mounted on an inclined support attached to the press frames of the delivery section of the press. Coating is circulated by recirculation means. Coating is supplied between the transfer means and the metering means, flows longitudinally along the length of the transfer and metering means and cascades at the ends thereof to a drip pan positioned below the metering means. A drip pan outlet is in operative association with the recirculation means, and the coating supply means communicates with the recirculation means, to supply recirculated coating to the transfer and metering means. The coating blanket mounted on the blanket cylinder and the press unit impression cylinder have substantially the same effective operating diameter. The apparatus includes means to control pressure or width of the nip between the transfer cylinder and the coating blanket cylinder. The apparatus also includes means to control the actuation, adjustment and speed of the transfer cylinder relative to the blanket cylinder. A gear is adapted to positively, drivingly, couple the coating blanket cylinder to the impression cylinder when the assembly is in the first (operating) position. The apparatus also includes means for adjusting the coating blanket cylinder relative to the press unit impression cylinder while the two cylinders remain drivingly engaged. An adjustable stop controls the nip between the coating blanket cylinder and the impression cylinder, without changing the relationship between the coating blanket cylinder and the liquid coating metering and transfer means. The coating blanket cylinder can be lightweight (aluminum) with means enabling lateral and/or circumferential register adjustment relative to the adjacent press impression cylinder.

This invention thus provides a direct coating system for a sheet fed printing press, preferably a multi-color press, and enables in line printing and coating at the same time on a single press unit, thus maintaining the printing capability of the printing press unit. When a press unit (preferably the final press unit) is retrofitted with the retractable coating assembly of this invention, an existing impression cylinder in the press unit acts as a common impression cylinder, so that ink is first applied to a sheet being fed on the impression cylinder and a coating is applied directly to the sheet over the last ink application. After this dual sequential application of ink and coating onto a sheet on the same impression cylinder, the coating can be suitably dried by air, infra red heat, ultra violet radiation or any other means adapted to quickly dry the coating.

This apparatus is capable of delivering a metered amount of coating through a special blanket roll to a sheet carried by the last impression cylinder in a printing press substantially without interrupting or changing the printing process. It allows spot coating or overall coating as may be desired by the printer. It operates without the use of bulky complex metering systems, yet the apparatus is versatile in that the printer can bring the coater in line or not, as he desires, without changing or interfering with an existing printing operation. Adjustment of the coating blanket cylinder and entire assembly is made relative to the impression cylinder to compensate for various sheet thicknesses to be printed. The assembly is furthermore actuatable while still drivingly

engageable with the impression cylinder, to on off positioning of the cylinder when operating in the first position.

The entire apparatus is further retractable to the second position by a simple retraction device, such as a linear-actuator, winch, hydraulic cylinder or the like (not shown), up an inclined plane (the same plane as for movement for adjustment and actuation), to provide access to: (1) the coating blanket cylinder for changing blankets, packing, clean up, maintenance, etc.; (2) the standard printing blanket cylinder; (3) the impression cylinder; and (4) the sheet delivery area, beneath the coating apparatus, housing the conventional Infra red or UV drying unit. In this second retractable position, the apparatus may be used as a seat by the operator, as desired, for standard printing press unit operation.

A gear cover is provided about the blanket cylinder gear and is designed to resiliently sealingly engage the gear cover of the printing unit to which the coating apparatus is installed. When the coating unit is retracted, a cover is supplied to seal the cutout in the press gear cover. Therefore the integrity of the oil bath is maintained within the press gear cover in both operating and retracted positions of the apparatus.

A specific sequence of actuation of the transfer roll relative to the coating blanket cylinder, and actuation of the coating blanket cylinder (and, therefore, of the entire assembly) relative to the impression cylinder for proper coating operation, is specifically discussed later herein. This apparatus is well adapted to be built into a new printing press or to be retrofited into existing equipment.

Other feathers and advantages of the invention will be apparent from the following description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the coating apparatus including a diagrammatic view of a printing press with which it is operatively associated. In this FIG. the cylinders of the coating assembly are shown in solid in their coating operating position and in phantom in their retracted position. The coating apparatus is shown in section.

FIG. 1A is a side view of stop on the coating apparatus of FIG. 1.

FIG. 2 is a diagrammatic side view of a set of coating application rollers showing details of controls for positively, drivingly, linking these rollers to a printing system; and

FIG. 3 is similar to FIG. 2 showing a schematic view of controls for the coating apparatus hereof for adjustment, actuation and retraction of the coating assembly relative to the press, actuation and adjustment of the transfer roll relative to the coating blanket cylinder and the metering means relative to the transfer roll.

FIG. 4 is a cross-sectional view taken along lines 4—4 from FIG. 1.

SPECIFIC EMBODIMENTS OF THE INVENTION

This invention will be described with reference to the drawing in which like parts have been given like reference characters.

Referring now to FIGS. 1 and 4, the coating apparatus assembly of this invention comprises a transfer roller 10, journalled for rotation, onto which is fed coating material 12, and a metering assembly 14 which is suitably adjustably mounted relative to the transfer roll to deliver a predetermined quantity of liquid coating, substantially evenly along the surface of the transfer roller 10. This metering assembly 14 includes a rotatably mounted journal 20 which is generally parallel to the axis of the metering roller 10. Mounted substantially centrally about the journal 20 is a housing 22 from which a blade clamp 24 extends. A doctor blade 26 is positioned in the blade clamp 24 and is angularly positioned against the metering roller 10. The doctor blade 26 is suitably made of blue spring steel, suitably about ten thousandths of an inch thick, and suitably extends out of the clamp 24 about one-half inch. The angular position of the blade 26 may be about 40° to a tangent to the transfer roller surface. It has been found to be useful to force the doctor blade 26 against the transfer roller 10 with a pressure of about one-half to one pound per linear inch. The transfer roll (with the metering device) is mounted at each end thereof in a common frame 16 which is in turn rotatably supported in a coater assembly housing 46. Frame 16 is pivotally rotated, or otherwise moved, by cylinder 57, not shown, to adjustably engage transfer roll 10 to a lightweight (e.g, aluminum) coating blanket cylinder 40 for proper coating application. Movement of frame 16 does not affect pressure between roller 10 and blade 26. Likewise, movement of housing 46 does not affect the pressure setting, or the relative positions, of transfer roll 10 and coating blanket cylinder 40. Adjustable stop 18 is provided to set a light "kiss" pressure between roller 10 and cylinder 40.

A drip pan 28 having an outlet is provided, and is positioned below the transfer roller 10 and the metering assembly 14. The pressure exerted by the doctor blade 26 against the metering roller 10 can be adjusted by means of two adjustment screws 27 which extend to corresponding adjustment brackets 29 clamped on the axle 20. It is preferred that the adjustment screws are attached to the brackets off center with respect to the axis of the axle 20 so that the rotation of these adjustment screws will pivot the axle 20 whereby changing the pressure of the doctor blade 26 on the roller 10. A cover may be provided over the coating 12 and roller 10.

A coating blanket cylinder 40 is provided in operative, takeoff contact with the transfer roller 10. The blanket roller has its own journals rotatably mounted, suitably in needle bearings, and supportingly attached to the same housing 46 as supports the common frame 16 for the transfer roller and metering assembly. This housing 46 is slidably mounted on rails 48 which, in a preferred embodiment of this invention, are inclined so as to easily move the coating assembly into and out of the line as well as provide a guide for adjustment and actuation of the coating blanket cylinder (and entire unit) relative to the impression cylinder of the press.

Specifically, the housing 46 is mounted on bearing blocks 50 that are in turn slidably mounted on the two parallel rails 48. The rails 48 are mounted on rail supports 52 which are adapted to be directly connected to the press unit.

Hydraulic cylinders 58 each with an adjustable clevis 62 are mounted on opposite sides of the housing 46 to provide proper actuation and a "kiss" pressure contact between the coating blanket on the special blanket cylinder 40 and the sheet on press impression cylinder 66. Suitably a latch 60 is provided to insure positive positioning and lock up of the entire coating assembly with relation to the printing unit, i.e., the coating blanket cylinder 40 with the impression roller 66.

Double adjusting screws 30 and 32 are supported by support 36 attached to housing 46. Screw 30 bears against stop block 38, attached to the press frame. Screw 32 is locked by nut 34. Rotation of screw 30 provides for paper pressure adjustment and thickness changes in sheet stock, while setting screw 32 provides a safety such that gears mounted on the coating blanket cylinder and press impression cylinder, cannot be meshed beyond a preset point while in the coating mode of operation. Once nut 34 is tightened, the nut is fixed (as if it were welded or pinned) for a specific screw 32 setting. Clearance "S_c" in FIG. 1 depends on the thickness of the sheet, S_t which is generally between 0.000 to 0.030 inches. As shown in FIG. 1, clevis 62 is adjusted such that a clearance exists within cylinder 58, between the piston and cylinder wall. The piston serves as an "OFF" stop for the coating assembly when the assembly is actuated. A separation will therefore exist between the blanket and sheet when in the "OFF" impression position. For a theoretical 0.000 sheet thickness, S_c should be set for 0.060 inches approximately.

A gear-motor 80, which may be hydraulic or electric, is suitably provided to drive the transfer roll 10. Suitable motorized means is provided to retract the coating assembly into and out of operative relation with the impression roller 66, up and down the rails 48.

The coating assembly is shown in cooperative relationship with a conventional series of printing rollers. The coating blanket on blanket cylinder 40 is in light "kiss" contact with the sheet on impression cylinder 66, the sheet on the impression cylinder being also in contact with a printing blanket on blanket cylinder 70; impression cylinder 66 thereby serves as a dual impression cylinder, first for printing and next for coating. The sheet work piece is shown at 72.

The coater is first locked into operation on the press unit by lowering it along the rails 48 toward the press unit and engaging clevis 62 to lug 61 mounted on the press through releasable latch pin 60. In operation, gear-motor 80 mounted on housing 46 rotates the roller 10 as coating fluid is pumped under pressure from a fluid reservoir (not shown) to an inlet opening in the doctor blade assembly. From there, coating spreads over the surface of roller 10 and is distributed by the doctor blade 26. A continuous flow of coating is maintained over the surface of the roller 10 and excess coating is recovered through a drip pan 28, with an outlet for recycling. In this way, sufficient flow is maintained to provide a flooded nip of coating between roller 10 and blade 26 and to provide uniformity of coating along the rollers' length. The amount of coating carried by the metering roller 10 can be adjusted somewhat by turning screws 27 to adjust the pressure between doctor blade 26 (or a metering roller) and the transfer roller 10, as described above. Hydraulic cylinders 58 serve to pull the entire unit against the press with a force that can be adjusted by adjusting the pressure in the cylinders 58. Screw 30 adjusts "ON" pressure between the coating blanket on blanket cylinder 40 and a sheet carried on impression cylinder 66. Cylinders 58 further serve to separate the coating blanket cylinder from the impression cylinder while gears mounted on the adjacent cylinders still remain in mesh. Separation or clearance "S_c" in FIG. 1 is about 0.060 to 0.030 inches to provide an "OFF" condition of the coater assembly to stop application of coating. As the blanket cylinder 40 rotates in direction R, coating is applied to the just printed sheet. Transfer roller 10 rotates as shown by direction R'.

A uniform amount of liquid coating is continuously transferred to the blanket roller 40 at the nip between the blanket roller 40 and the transfer roller 10. The blanket roller 40 in turn delivers that coating to the workpiece as the workpiece travels through the nip between the blanket roller 40 and the impression roller 66. Changing the speed of roller 10 results in a change of coat weight added to the sheet.

When the coater is not in use, latch pin 60 is released, and a motorized drive moves the coating unit back along the rails 48 away from the printing rollers.

More specifically, when using an acrylic water based coating, a suitable transfer roller may be a quadrangular cell cylinder, having about 140 lines/inch, each square inch of cells carry 15 cubic billion microns of coating. A suitably engraved roller is sold by Pararco Roller Co. of Dallas, Tex. (Exact roll cell nomenclature is: 140 Rotoflo/138 for an optimum roll surface structure.) An acrylic water-based coating having about 45% solids can be applied to achieve an optimum dry coat weight of $\approx$0.4–0.6 pounds per 1000 square feet, using a roll speed of 1:1 with that of coating blanket roll 40.

Referring now to FIG. 2, there is shown a portion of a coating apparatus assembly including transfer roller 10, coating material 12 fed from a supply thereof 13 and metered onto the roller by means of a doctor blade assembly 14, including a drip pan 28. The transfer roller 10 is suitably driven by direct drive gear motor 80 whose speed is controlled by a controller 82 responding to sensor 84 which senses the speed of the coating blanket cylinder 40. Controller 82 is adjusted to provide a preset surface speed ratio, 1:1 or less, between roller 10 and cylinder 40, the slowest surface being that of roller 10. Impression cylinder 66 includes a sheet gripper 95. The coating blanket on blanket cylinder 40, and associated drive gear 40', preferably have the same operative diameter as the impression cylinder 66 and press gear 66'. Gear 40' is directly driven by press gear 66' of cylinder 66 so as to insure a positive drive relation therebetween. In FIG. 2, no worksheet is shown in this figure for clarity. Index marks are placed on adjacent gears to insure proper register of adjacent cylinders. The gear pitch line separation "P.L.S." is approximately equal to the sheet thickness "Sht.Thk.", S_t, shown on cylinder 66. D_{40} is a broken line corresponding to the outer diameter of the blanket on cylinder 40, and the pitch line of gear 40' and D_{66} is a broken line corresponding to the outer diameter of impression cylinder 66 and the pitch line of gear 66'. R_{40} is equal to R_{66} and thus D_{40} and D_{66} are equal.

Referring now to FIG. 3 which is similar to FIG. 2, there is shown the same three rollers, the transfer roller 10, the coating blanket cylinder 40 and the dual, common, impression roller 66. The transfer roller 10 and the coating blanket roll 40 are shown commonly mounted in assembly 46 via bearing blocks 50, on inclined rails 48. There is shown in this figure a first cylinder 57 with stop 18 which adjusts the pressure in the nip 90 between the transfer roller 10 and the coating blanket on blanket cylinder 40. A second cylinder 58 and screw 30 are provided to control the spacing in the nip 94 between the coating blanket on the blanket cylinder 40 and the dual impression cylinder 66 to accomodate a particular sheet thickness. The last color printing blanket roll 70 is not shown for clarity. Frame 16 pivots at P in FIG. 3.

FIG. 4 is a sectional view taken along lines 4—4 of FIG. 1 showing relationship or roll lengths to each other, a cover A' about the coating blanket cylinder

drive gear, lateral and circumferential register provisions for the coating blanket cylinder, B' and C' respectively and other component parts shown in FIG. 1.

As best shown in FIG. 4, housing 46 is offset to the inside of the press frame in the area of the bearings for coating cylinder 40, and therefore clears the press frame in this area. The remainder of the housing may lie along the inclined surface of the frame; that is, directly above the frame. This offsetting of housing 46 prevents having to alter (cut away) a portion of the press frame adjacent the bearing.

For sequencing of rolls for proper coating operation, the following procedure is followed:

"ON" 1. Transfer roll actuates to coating blanket cylinder upon actuation of press blanket cylinder of last printing unit.

2. Coating blanket cylinder actuates to sheet on press impression cylinder upon one full revolution of press.

"OFF" 1. Transfer roll separates from coating blanket cylinder upon actuation of blanket cylinder of preceeding press unit.

2. Coating blanket cylinder separates from the sheet on the press impression cylinder upon actuation of the press blanket cylinder of the last printing unit.

OTHER EMBODIMENTS

Other embodiments are within the following claims. For example, other doctor blade arrangements may be used to doctor the coating from the transfer roller 10, such as a system utilizing a reverse angle blade or having dual blades and having a coating inlet between the two blades. A roll, or roller means, may also replace the doctor blade arrangement. Other types of engraved or smooth surfaced cylinders may be used. Other types of presses may be used in conjunction with the coater, but offset lithographic sheet feeding presses are preferred.

I claim:

1. An apparatus for applying a liquid coating to a sheet workpiece, said apparatus being adapted for operation on line with a unit of a sheet-fed lithographic printing press, said press unit comprising a press unit blanket on a press unit blanket cylinder engageable at a first printing location on a sheet workpiece on a press unit impression cylinder; said apparatus comprising:

a liquid coating supply means;

a coating blanket cylinder adapted to provide a coating surface;

a means for metering and transferring liquid coating material operatively connected to said coating surface on said coating blanket cylinder and to said liquid coating supply means, for applying a controlled amount of coating on said coating surface of said coating blanket cylinder;

structural members integrating said means for metering and transferring coating material and said coating blanket cylinder into an independent, cooperatively operating, coating assembly;

means for positively driving said coating blanket cylinder in association with said press unit impression cylinder; and

mounts for guiding movement of said coating assembly between an operative position in which said coating surface on said coating blanket cylinder is operatively engaged with a second location on said sheet on said press unit impression cylinder and an off imprint position in which said coating surface on said coating blanket cylinder is slightly separated from said sheet workpiece on said press unit impression cylinder, said coating assembly including said means for metering and transferring coating material, remaining intact during movement of said coating assembly;

whereby in said operative position, said coating surface continuously delivers a smooth, uniform, metered amount of said liquid coating material to said sheet workpiece on said impression cylinder at said second location on said impression cylinder while printing is being applied by said press unit blanket to said sheet workpiece at said first location on said impression cylinder.

2. The apparatus of claim 1 wherein said means for metering and transferring coating comprises a transfer cylinder in operative contact with said coating surface on said coating blanket cylinder and means for metering the amount of coating carried on said transfer cylinder.

3. The apparatus claimed in claim 2 wherein said means for metering is a doctor means comprising an elongated blade edge positioned against said transfer cylinder.

4. The apparatus claimed in claim 1 wherein said coating assembly is mounted on an inclined support.

5. The apparatus claimed in claim 1 further including a drip pan positioned below said metering and transferring means comprising an outlet, and recirculation means in operative association with said outlet, said liquid coating supply means communicating with said recirculation means to deliver recirculated liquid coating material to said means for metering and transfering.

6. The apparatus claimed in claim 1 wherein said coating surface on said coating blanket cylinder and said impression cylinder have substantially the same effective operating diameter.

7. The apparatus claimed in claim 2 including means to control the nip betwen said transfer cylinder and said coating surface on said coating blanket cylinder.

8. The apparatus claimed in claim 1 including a gear adapted to positively couple said coating blanket cylinder to said impression cylinder when said coating assembly is in said first operating position.

9. The apparatus of claim 1 further comprising means for adjusting the coating blanket cylinder relative to the impression cylinder, while the coating blanket cylinder remains drivingly engaged with the impression cylinder.

10. The apparatus of claim 9 comprising an adjustable stop to control the nip between the coating surface on said coating blanket cylinder and the workpiece sheet on said impression cylinder, without changing the coating blanket cylinder relationship to the liquid coating metering and transfer means.

11. The apparatus of claim 1 wherein the coating blanket cylinder is a lightweight cylinder.

12. The apparatus of claim 1 wherein said coating blanket cylinder further comprises means for circumferential register with the adjacent press impression cylinder.

13. Apparatus of claim 12 wherein the coating blanket cylinder further has means enabling lateral register adjustment relative to the adjacent press impression cylinder.

14. Apparatus according to claim 13 wherein said coating blanket cylinder is adapted to receive a photopolymer plate and wherein said means for metering and transfering coating comprises a transfer cylinder, the surface of which is a transfer surface, said transfer sur-

face and the surface of said photopolymer plate being adapted for rotation together in nip contact at substantially the same surface speeds for precision spot coating to said sheet workpiece.

15. Apparatus according to claim 1 wherein said mounts guide said coating assembly to move to a fully-retracted position in which said coating assembly and coating blanket cylinder are completely disengaged from said press unit impression cylinder at a remote location from the press unit cylinders.

16. Apparatus according to claim 1 wherein said blanket cylinder is adapted to receive a blanket for coating said sheet workpiece.

17. Apparatus according to claim 1 wherein said blanket cylinder is adapted to provide a coating plate at its surface.

* * * * *

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US005107790A

United States Patent [19]

Sliker et al.

[11] Patent Number: 5,107,790

[45] Date of Patent: Apr. 28, 1992

[54] TWO HEADED COATER

[75] Inventors: Larry J. Sliker, Livonia; Robert S. Conklin, Rochester, both of N.Y.

[73] Assignee: Rapidac Machine Corp., Rochester, N.Y.

[21] Appl. No.: 463,115

[22] Filed: Jan. 11, 1990

[51] Int. Cl.[5] B05C 1/08; B05C 11/00

[52] U.S. Cl. 118/674; 118/46; 118/212; 118/249; 118/255; 118/258; 118/262

[58] Field of Search .... 118/674, 46, 249, 255, 118/258, 262, DIG. 1; 101/247, 329, 352

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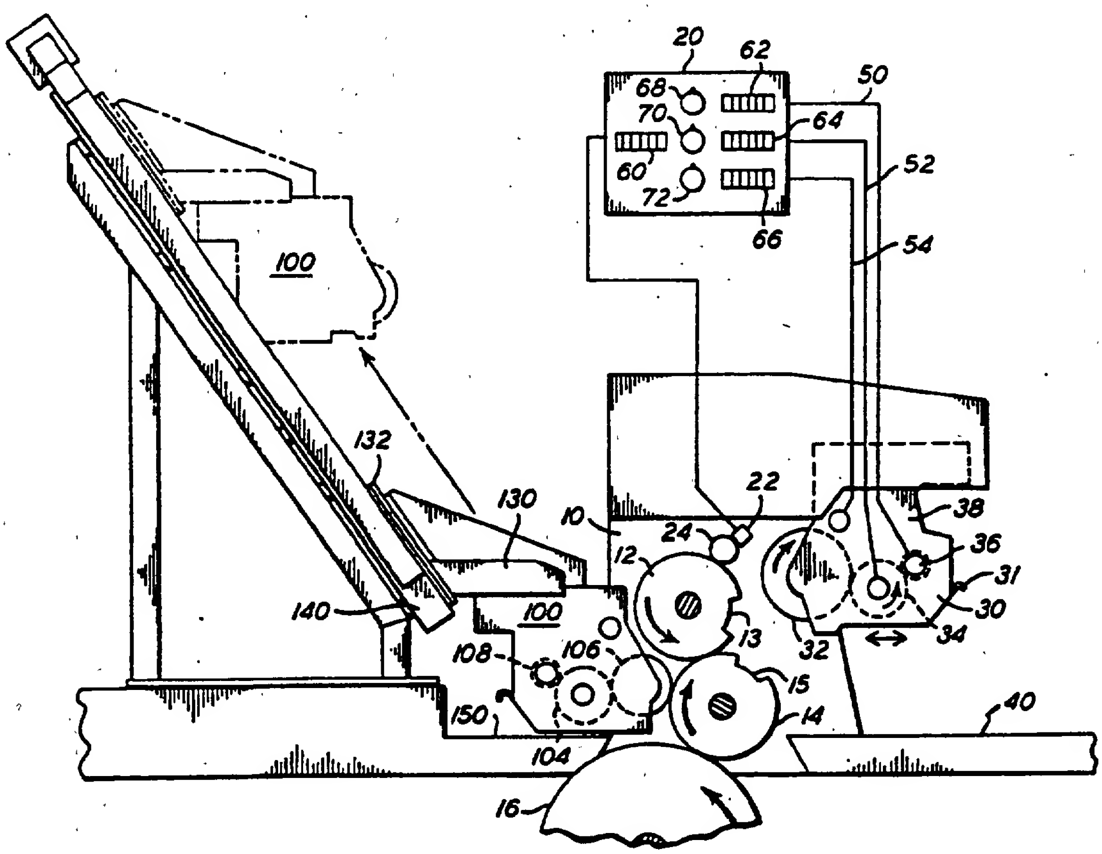
Primary Examiner—Michael G. Wityshyn
Attorney, Agent, or Firm—Cumpston & Shaw

[57] ABSTRACT

Coating apparatus for applying continuous or spot coatings to an image printed surface includes a plate cylinder; a blanket cylinder for transferring a coating material from the plate cylinder to the copies; a blanket coating roller for transferring a continuous layer of coating material to the blanket cylinder; a plate coating roller for selectively applying spot coating material to the plate cylinder; a first retractor for moving the blanket coating roller laterally into and out of transferring engagement with the blanket cylinder; and a second retractor for moving the plate coating roller into and out of transferring engagement with the plate cylinder.

14 Claims, 3 Drawing Sheets



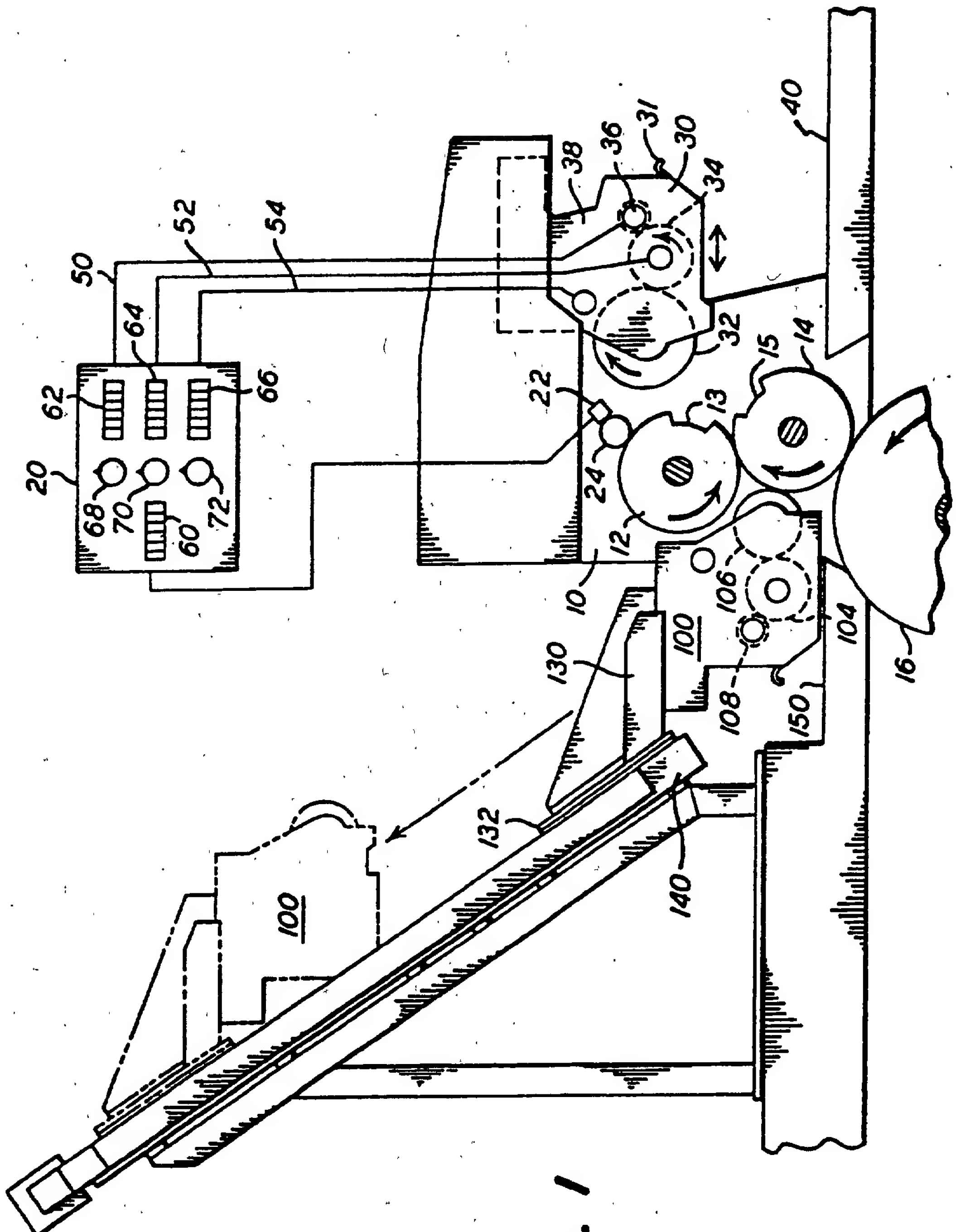

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FIG. 1

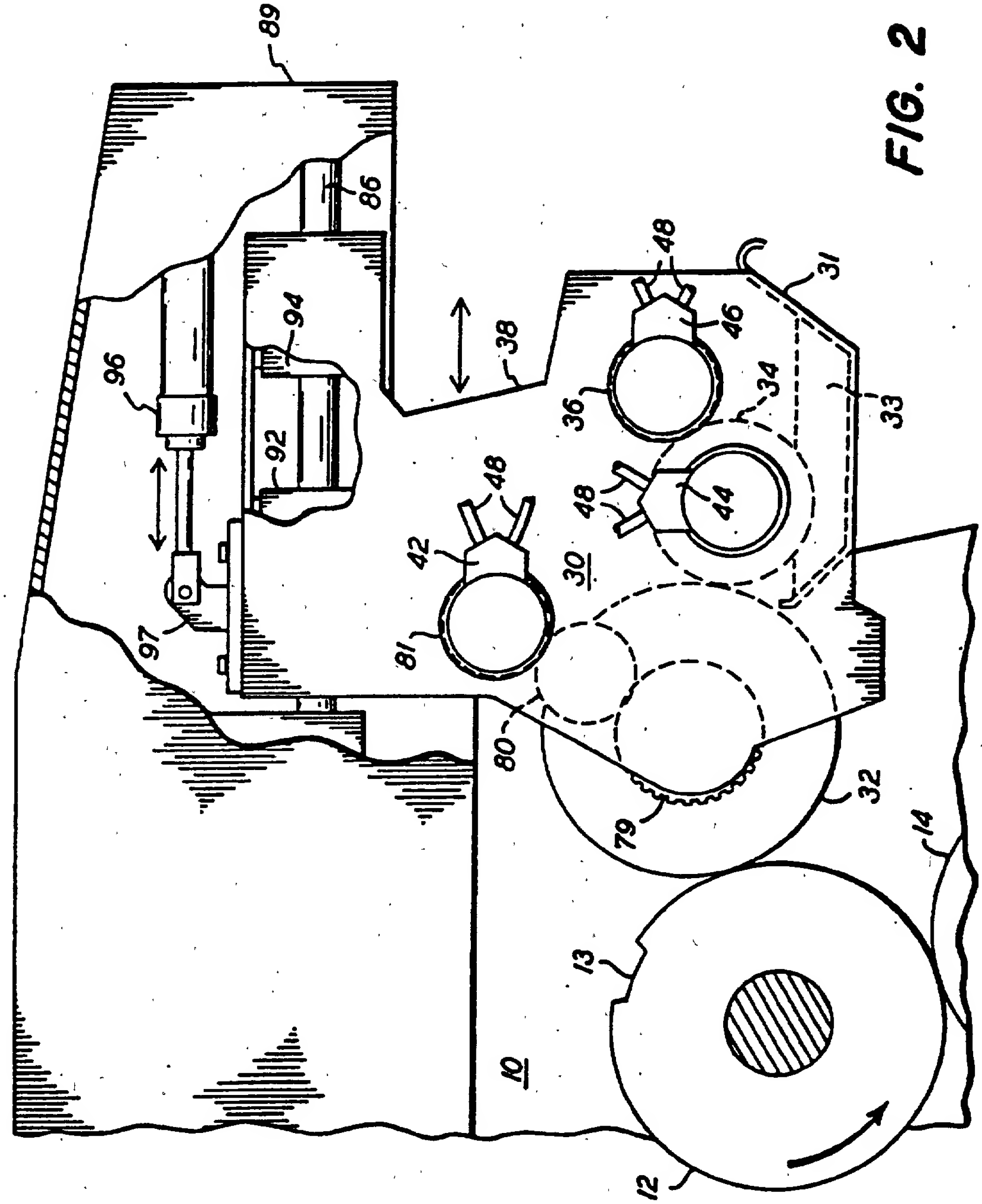
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FIG. 2

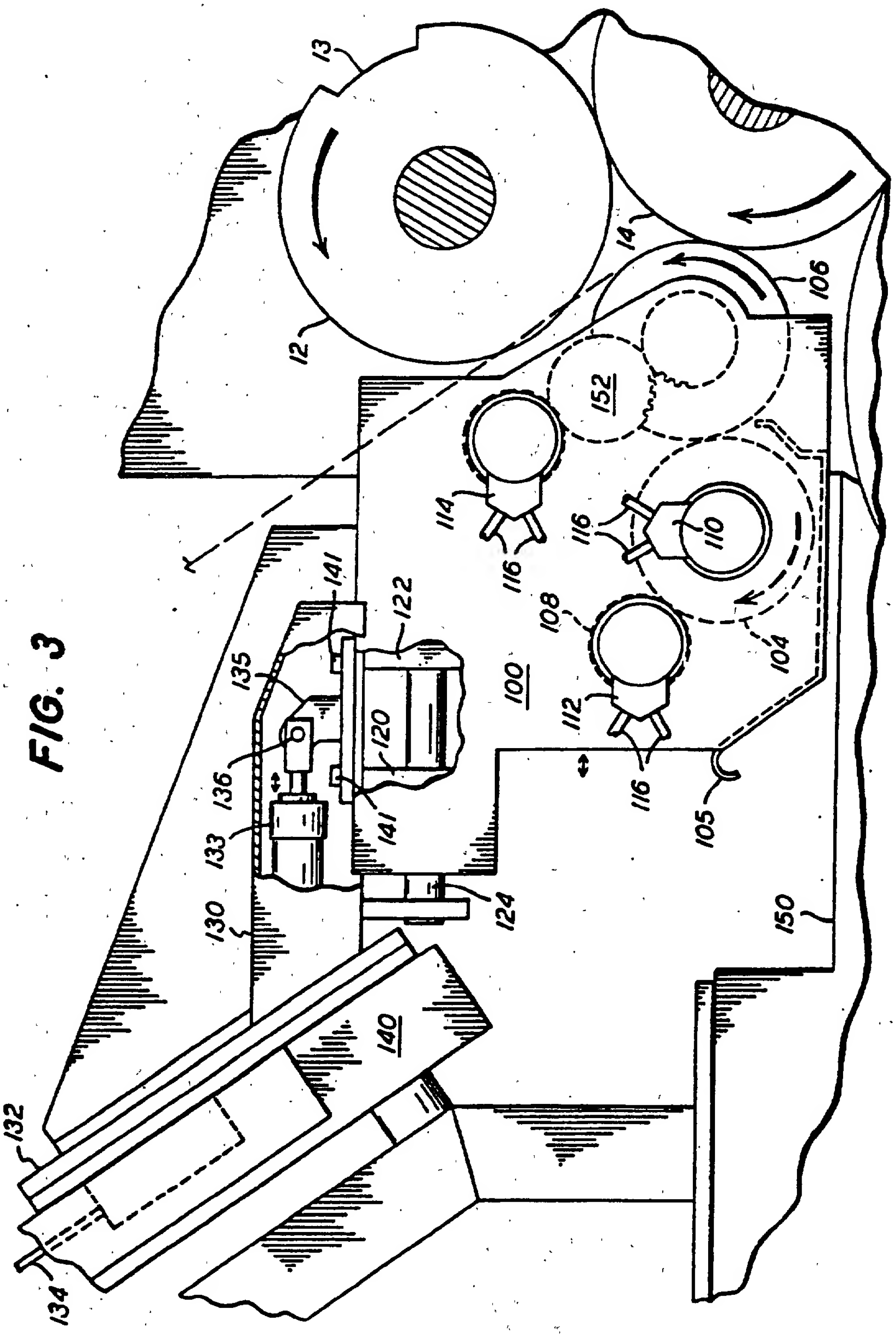
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FIG. 3

TWO HEADED COATER

This invention relates in general to coating apparatus for printing presses, and more particularly to a dual headed coater adapted to provide overall or spot coating on a printed sheet or web as a final or near final step in the printing process.

The advantages of coating printed sheets are well known, and much effort has been expended in providing satisfactory apparatus for carrying out the coating process. Among the many patents relating to coating apparatus are U.S. Pat. Nos. 4,615,293, 4,569,306, 4,685,414, 4,446,814, 4,421,027, 4,399,767, 4,397,237, 4,308,796, 4,270,483, and 3,931,791.

For flexibility and to reduce costs, printing presses are often assembled from a plurality of substantially identical printing units, the number of units used being determined by the number of colors to be printed. Each printing unit applies a different color ink to the sheet or web to form the printed image. It is advantageous, to reduce costs, and maintain flexibility in adapting the press to different jobs, to provide coating apparatus that may be selectively engaged with the plate or blanket cylinders of an existing printing unit to carry out the coating operation and disengaged so that the printing unit can be used for its normal purpose or allowed to idle when coating is not required.

Among the patents mentioned above, Jahn U.S. Pat. No. 4,615,293 shows a medium applicator for a printing machine. The medium applicator (coater) is disposed downstream of the printing units of the machine, and includes two applicator rollers, one contacting the roller that would function as the plate roller in a conventional printing unit and the other contacting the blanket cylinder. The coating rollers are disposed on the upstream side of the plate and blanket cylinders respectively of the coating assembly.

Although the coating apparatus described in the Jahn patent is theoretically capable of carrying out the spot and blanket coating operations as described, in practice, the arrangement shown in the Jahn patent is impractical, and would be of little use in a large scale printing application.

Printers can produce high volumes of printed material rapidly through the use of modern printing presses. The presses are extremely expensive, and the amount of time required to reconfigure the press from one job to another is non-productive, and costly. Accordingly, there is a need for presses and associated coating apparatus that minimize the time required to clean up from one run, and set up and commence the next run. Although versatile coaters that can apply spot and blanket coatings are desirable, ordinarily only one coater at a time is actually in operation. Where consecutive jobs require the same sort of coating, particularly blanket coating, it may not be necessary to clean up the coater between jobs. However, the coating lacquers cannot be allowed to dry on the rollers, and therefore, especially when switching from blanket to spot coating or vice-versa, or if there is a wait between jobs, it is necessary to clean up the coaters after each job is completed. In addition, cleanup is necessary when switching between different coating compositions, such as aqueous and u-v coatings. Such coatings are incompatible, and the coaters must be cleaned between applications of such different coatings.

Modern high speed printing presses are dangerous to work around in ordinary circumstances, and are particularly dangerous when operating at full speed. It would be virtually impossible to clean the prior art coaters such as the coater shown in the Jahn patent while the press is operating, and especially difficult for example to clean the blanket coater while printing spot coatings on a subsequent job.

Accordingly, it is an object of this invention to provide coating apparatus for applying continuous or spot coatings to an image printed surface comprising: a plate cylinder; a blanket cylinder for transferring a coating material from the plate cylinder to the copies; a blanket coating roller for transferring a continuous layer of coating material to the blanket cylinder; a plate coating roller for selectively applying spot coating material to the plate cylinder; first retracting means for moving the blanket coating roller laterally into and out of transferring engagement with the blanket cylinder; and second retracting means for moving the plate coating roller into and out of transferring engagement with the plate cylinder.

It is another object of this invention to provide coating apparatus of the type described and further including tachometer or other means responsive to the rotation of the plate and blanket cylinders for providing speed signals proportional to the press speed and control means responsive to the speed signals for controlling the speed of the plate and blanket coating rollers.

It is another object of this invention to provide drive means for the plate and blanket coating rollers, and independent controllers for each of the drive means permitting the relative speeds of the plate and blanket coating rollers and plate and blanket cylinders respectively, to be continuously controlled to adjust the shear at the nip between the rollers and the cylinders at various press speeds for enhancing the coating operation.

It is still another object of this invention to provide a retracting assembly for moving one of the plate and blanket coating rollers horizontally into and out of engagement with one of the plate and blanket cylinders, and for lifting the coating roller assembly away from the cylinder for easy access during cleaning.

It is still another object of this invention to provide means for translating the other coating roller into and out of engagement with the other cylinder, the out of engagement position adapted to permit cleaning of the roller and associated apparatus.

It is a still further object of this invention to provide control means responsive to sensing tachometers or other means providing signals proportioned to press speed coupled to the plate and blanket cylinders for controlling the rotation of the coating rollers and associated pick up and metering rollers for controlling the amount of coating material applied to the printed page.

It is a still further object of this invention to provide control means for incrementally adjusting the relative speed of the pickup, metering, and coating rollers relative to the speed of the plate and blanket cylinders.

It is a feature of this invention that coating rollers can be employed, because of the placement thereof on opposite sides of the press unit, that are larger in diameter than those utilized in prior art coaters. The use of large diameter coating rollers reduces the speed of rotation of the rollers, and thereby the tendency of the rollers to sling coating material off the surface by centrifugal force. This is especially advantageous in pattern or spotting coating operations, where the surface speeds of

the applicator roller and plate cylinder must be the same. The use of larger rollers reduces the centrifugal force produced at the surface of the applicator roller, thus greatly reducing the slinging or misting of coating material, when the present invention is employed. Slinging or misting of coating material greatly increases the difficulty of cleanup after a coating operation.

While the novel aspects of the invention are set forth with particularity in the appended claims, the invention itself, together with further objects and advantages thereof, may be more readily understood by reference to the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation of a two headed coater in accordance with this invention;

FIG. 2 is an enlarged segmental side elevation of the plate coating assembly of the two headed coater of FIG. 1; and

FIG. 3 is a segmental side elevation of the blanket coating assembly of the two headed coater of FIG. 1.

Referring now to FIG. 1, a simplified view of a printing unit, preferably the last unit, of a multi-stage offset printing press is illustrated with the coating apparatus of the invention operatively associated therewith. The coating apparatus of this invention is specially adapted to allow it to be retrofitted to a variety of printing units, either during manufacture, or after a press has been installed in a print shop. The damping and inking systems employed in a conventional printing unit are not shown. They may be omitted if the coating unit is designed solely for coating, removed, or simply disengaged or not used in a printing unit retrofitted for coating in accordance with this invention. The unique construction of the two headed coater of this invention permits the coating rollers to be moved into contact with the plate cylinder and blanket cylinder of the converted printing unit, and to be withdrawn to accessible positions for cleaning when not in use.

Printing unit 10 includes a plate cylinder 12 and a counter rotating blanket cylinder 14. As used herein, plate and blanket cylinder refer to the assemblies including plates and blankets, and associated clamps and the like, that are disposed in recesses 13 and 15 shown schematically in the drawing for simplicity. Blanket cylinder 14 contacts an impression cylinder 16 under some pressure and the printed sheet is normally passed through the nip between the blanket and the impression cylinders in a manner well understood by those skilled in the art. Conventional drive means, including cylinder gear wheels, a main driver motor and associated controls, not shown, synchronize the rotation of the plate cylinder, blanket cylinder, and impression cylinder, with the rest of the press.

A controller 20 continuously monitors the press speed through the use of a speed sensor, such as tachometer 22, which may be an optical encoder having a wheel 24 arranged to bear against the plate cylinder (or the blanket cylinder if it is more accessible) for providing a continuous speed signal to controller 20. As used herein, the term tachometer is intended to encompass any device that provides a signal from which the relative speed of the press may be determined. Many presses incorporate such devices internally, and the outputs from internal tachometers of whatever sort are often suitable as speed signals for the coaters of the present invention.

Turning now to the spot coater assembly of the invention, the assembly 30 includes a coating roller 32, a pick up roller 34, and a metering roller 36, all journalled in a conventional fashion in a laterally translatable frame 38 as will be more fully described in connection with FIG. 2.

Referring to FIG. 2, pickup roller 34 is adapted to be at least partially immersed in a container 31 of coating material, such as lacquer 33. The container is omitted from FIG. 1 of the drawing, so as not to obscure the remaining elements. Pick up roller 34 rotates counter clockwise, and metering roller 36, by virtue of the spacing at the nip and the relative speed thereof with respect to the pickup roller, controls the amount of coating material transferred to the coating roller 32 from pickup roller 34. Spot coating assembly 30 is shown in its retracted position in FIG. 1. In this position the assembly is accessible for cleaning, even while the press is running. To this end, a work space is provided adjacent to the coating assembly on a platform 40 on which an operator may stand, to gain access to the spot coating assembly for service and cleaning.

Referring now to FIG. 2, the spot coater 30 is shown in its operating position with coating roller 32 engaging plate cylinder 12. Each of the rollers 32, 34, and 36 of the spot coating assembly 30 is driven by a separate hydraulic motor 42, 44 and 46 respectively. Conventional hydraulic lines 48 convey pressurized hydraulic fluid from a pump and controller valves to the motors and provide for a return to the pump (not shown). The control valves are connected to controller 20. A speed sensor is provided on each of hydraulic motors 42, 44 and 46. The speed sensors are connected to controller 20 via sensing lines 50, 52 and 54. Controller 20 preferably includes conventional displays such as digital for the press speed 60, metering roller speed 62, pickup roller speed 64, and plate coating roller speed 66. The speed of each of the metering, pickup and coating rollers is adjustable by means of controls 68, 70 and 72 respectively that are coupled to the controller valves. In addition, controller 20 is responsive to the press speed as sensed by tachometer 22 for correspondingly increasing or decreasing the speeds of the motors driving pickup, metering and coating rollers, so as to maintain synchronization with the press. It will be understood that synchronization does not necessarily mean that all of the rollers are driven in such a manner as to provide zero slip (relative speed) at the nips, but rather that the desired conditions, which may include relative shear at the nips, are maintained as the press speed is increased. In accordance with a presently preferred embodiment of the invention, the relative speeds of the rollers are set while the press is running at a low speed, and the controller 20 adjusts the speeds of the motors driving the pickup, metering and coating rollers, to maintain the same relative speed as the press speed increases. By adjusting controls 68, 70 and 72, the relative speeds may be fine tuned at any press speed.

As shown in FIG. 2, pickup roller 34 and metering roller 36 are driven directly by hydraulic motors 44 and 46 respectively, while coating roller 32 is driven indirectly by the motor via gear wheels 79, 80, and 81. Those skilled in the art will recognize that the precise manner in which the rollers are driven may be changed to accommodate different arrangements, the particular arrangement shown in FIG. 2 therefore representing only an example of a presently preferred embodiment of the invention.

Frame 38 of spot coating assembly 30 is laterally translatable on horizontally disposed traverse rod 86 rigidly mounted in a support 89, which is attached to coating unit 10. Frame 38 is attached to bearing blocks 92 and 94, that slidably engage rod 86. Linear hydraulic actuator 96 is attached to bracket 97 of frame 38 at one end, and to support 89 at the other, for laterally translating coating assembly 30 into and out of engagement with plate cylinder 12 as illustrated in FIGS. 1 and 2 respectively.

While plate coating assembly 30 is supported on a cantilevered arm of support 89 in accordance with a presently preferred embodiment of this invention, other functionally equivalent arrangements might be useful on printing stages having different configurations from the ones shown.

Referring now to FIGS. 1 and 3, the blanket coating assembly 100 of the invention is shown. Like the spot coating assembly, blanket coating assembly 100 includes a pickup roller 104 extending into a tray 105 adapted to contain a supply of coating liquid, such as lacquer or the like. Pickup roller 104 rotates clockwise and transfers the coating liquid onto blanket coating roller 106 in an amount determined by metering roller 108. The pickup, metering and blanket rollers are driven by hydraulic motors 110, 112 and 114 respectively, either directly or via gear wheels in like manner to the plate coater already described. The motors are supplied with pressurized hydraulic fluid through lines 116 in the manner already described in connection with the plate coating assembly 30. Similarly, speed sensors, not shown, are operatively engaged with each of the rollers or the motors to provide feedback signals representing the rotational speed of the rollers.

Blanket coating assembly 100 is carried by bearing blocks 120 and 122 slidably mounted on traverse rod 124, which is rigidly attached to cantilever arm 130 of carriage 132. Linear hydraulic actuator 133 has one end 136 coupled to a bracket 138, which is attached to blanket coating assembly 100 by bolts 141, or in other convenient fashion. Operation of actuator 134 translates plate coating assembly 100 into and out of engagement with blanket cylinder 14. Carriage 132 is attached to lifting cable 134, which extends up track 140 to conventional lifting means (not shown) to permit blanket coating assembly 100 to be raised to the position shown in phantom in FIG. 1, for cleaning or other servicing. Conventional means, such as a linear hydraulic actuator attached to cable 134, are employed to pull carriage 132 to the raised position. It will be appreciated by reference to FIG. 3, that it is necessary to laterally translate assembly 100 to the left before raising the carriage, in order that blanket coating roller 106 will clear the periphery of plate cylinder 12, as the carriage is raised.

When the carriage is raised, space is created on platform 150 for an operator to service blanket coating assembly 100.

It will be understood that a second controller unit similar to controller 20 is provided for controlling the rotation of pickup roller 104, metering roller 108 and coating roller 106. This controller is not shown in the drawings, because the connections thereto would obscure the remaining elements of the invention and are in any event identical to those already shown and described in connection with the plate coater. As was the case in connection with spot coater 30, hydraulic motor 14 drives coating roller 106 through an intermediate gear 152 in conventional fashion.

While the invention has been described in connection with a presently preferred embodiment thereof, those skilled in the art will recognize that certain modifications and changes may be made therein without departing from the true spirit and scope of the invention, which accordingly is intended to be defined solely by the appended claims.

What is claimed is:

1. Coating apparatus for applying continuous or spot coatings to a plate cylinder and a blanket cylinder of a printing press in which the plate cylinder is disposed generally above the blanket cylinder and arranged so that either of a plate coater and a blanket coater can be serviced while the other coater is operating;

a retractable blanket coater disposed on one side of the plate and blanket cylinders for transferring a layer of coating material to the blanket cylinder;

a retractable plate coater disposed on a side of the plate and blanket cylinders opposite the blanket coating roller for applying coating material to said plate cylinder;

blanket coater retracting means for moving said blanket coater between an operating position in contact with said blanket cylinder and a service position out of contact with the blanket cylinder;

plate coater retracting means for moving said plate coater between an operating position in contact with said plate cylinder and a service position out of contact with the plate cylinder; and

lifting means for lifting the blanket coater away from the blanket cylinder so that when one of the plate and blanket coaters is operating and the other is out of contact, the out of contact coater may be serviced without interfering with the operation of the operating one of the plate and blanket coaters.

2. The coating apparatus of claim 1 in which the plate coater comprises a plate coating roller and in which the blanket coater comprises a blanket coating roller and a plate coater motor for rotating said plate coating roller; a blanket coater motor for rotating the blanket coating roller; and also comprising

speed sensor means for providing a press speed signal; and

control means responsive to the press speed signal for controlling the speed of the plate coater motor and the blanket coater motor.

3. The coating apparatus of claim 2 wherein sid speed sensor means comprises tachometer means coupled to one of the plate cylinder and the blanket cylinder.

4. The coating apparatus of claim 2 further comprising a pickup roller for transferring a coating liquid to the plate coating roller and a metering roller for controlling the amount of coating liquid transferred to the plate coating roller.

5. The coating apparatus of claim 4 further comprising motor means for rotating the pickup roller and the metering roller.

6. The coating apparatus of claim 5 wherein said control means is connected to sid motor means for varying the speed of the pickup roller and the metering roller in response to the press speed signal.

7. The coating apparatus of claim 2 further comprising a pickup roller for transferring a coating liquid to the blanket coating roller and a metering roller for controlling the amount of coating liquid transferred to the blanket coating roller.

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US005176077A

United States Patent [19]

DeMoore et al.

[11] **Patent Number: 5,176,077**

[45] **Date of Patent: Jan. 5, 1993**

[54] **COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES**

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[73] Assignee: **Howard W. DeMoore**, Dallas, Tex.

[21] Appl. No.: **752,778**

[22] Filed: **Aug. 30, 1991**

[51] Int. Cl.^{5} **B41F 9/00**

[52] U.S. Cl. **101/142**; 101/147; 101/232; 101/348; 118/46

[58] Field of Search .... 101/135, 424.1, 142, 101/148, 155, 157, 177, 217, 232, 246, 329, 330, 331, 408, 409, 419, 422, 348-349; 118/46, 211, 236, 249, 257, 258, 261, 262, 263, 206, DIG. 15

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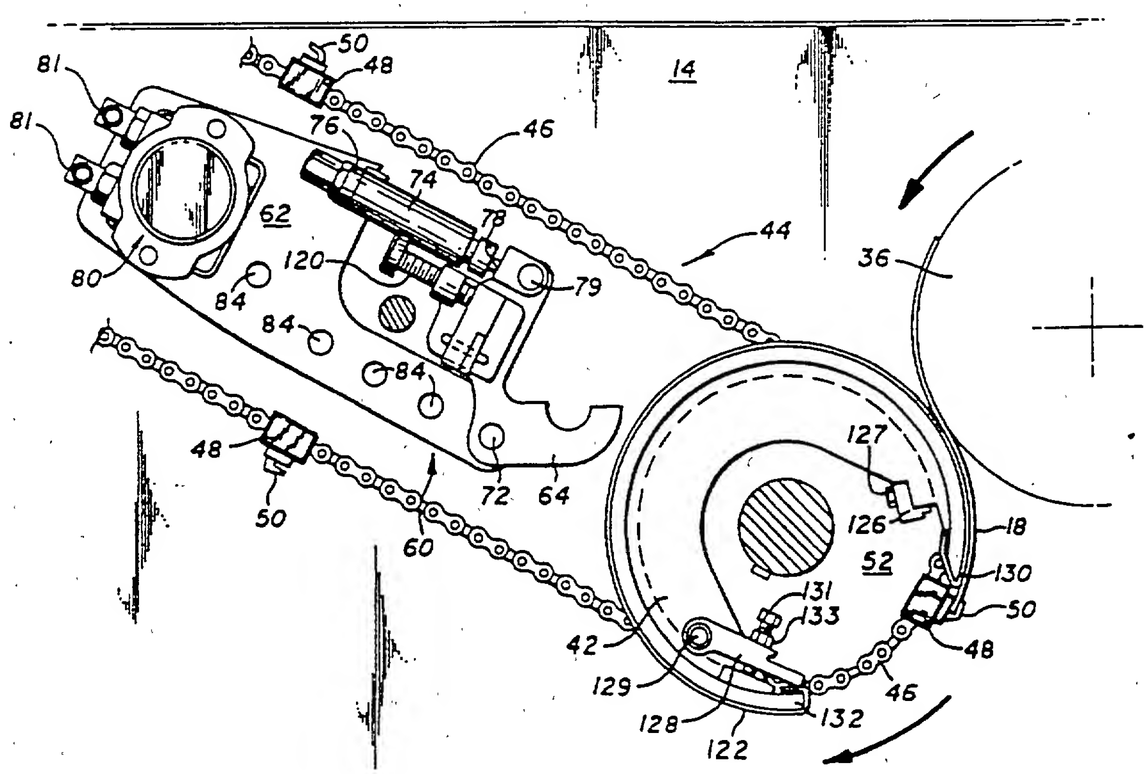
Primary Examiner—Eugene H. Eickholt
Attorney, Agent, or Firm—Dennis T. Griggs

[57] **ABSTRACT**

A coating apparatus for use in a sheet-fed, offset rotary printing press to selectively apply a protective and/or decorative coating to the wet ink surface of freshly printed sheets and including a coating unit having a pick-up roller for supplying aqueous coating material from a reservoir to the surface of a delivery cylinder mounted on a press delivery drive shaft, the delivery cylinder performing the dual function of a coating applicator roller and a delivery cylinder during coating operations.

22 Claims, 5 Drawing Sheets



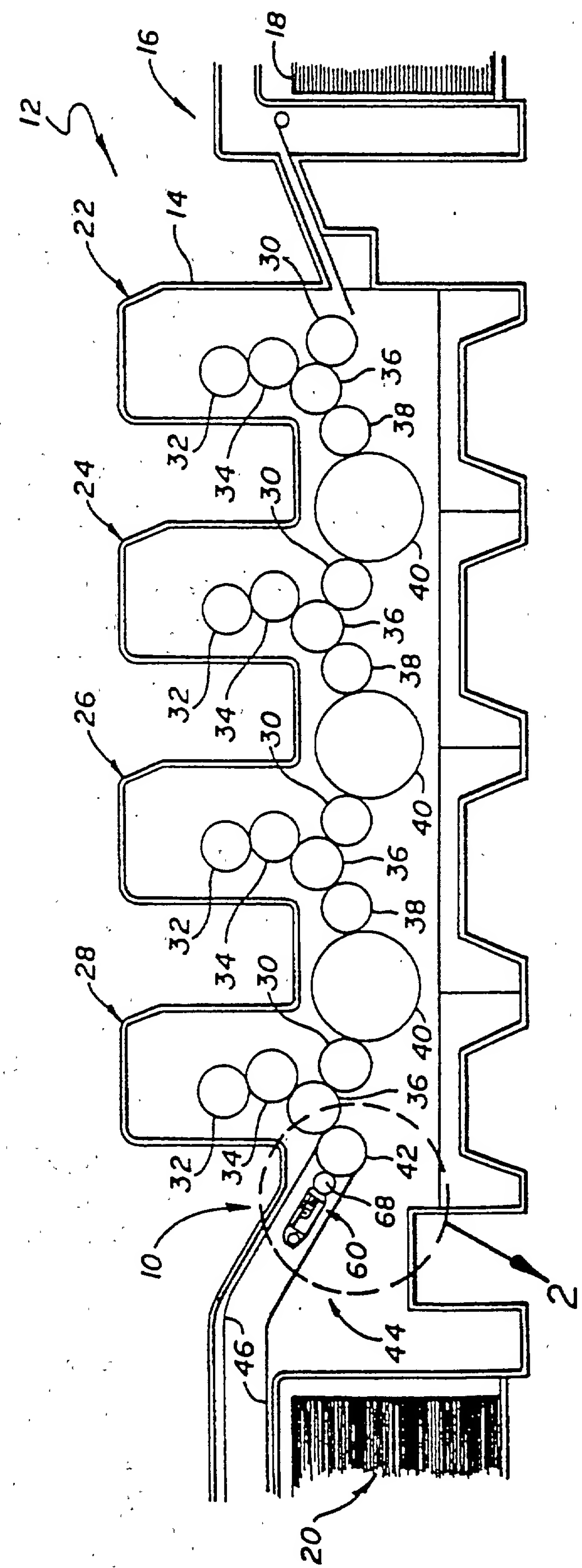


FIG. 1

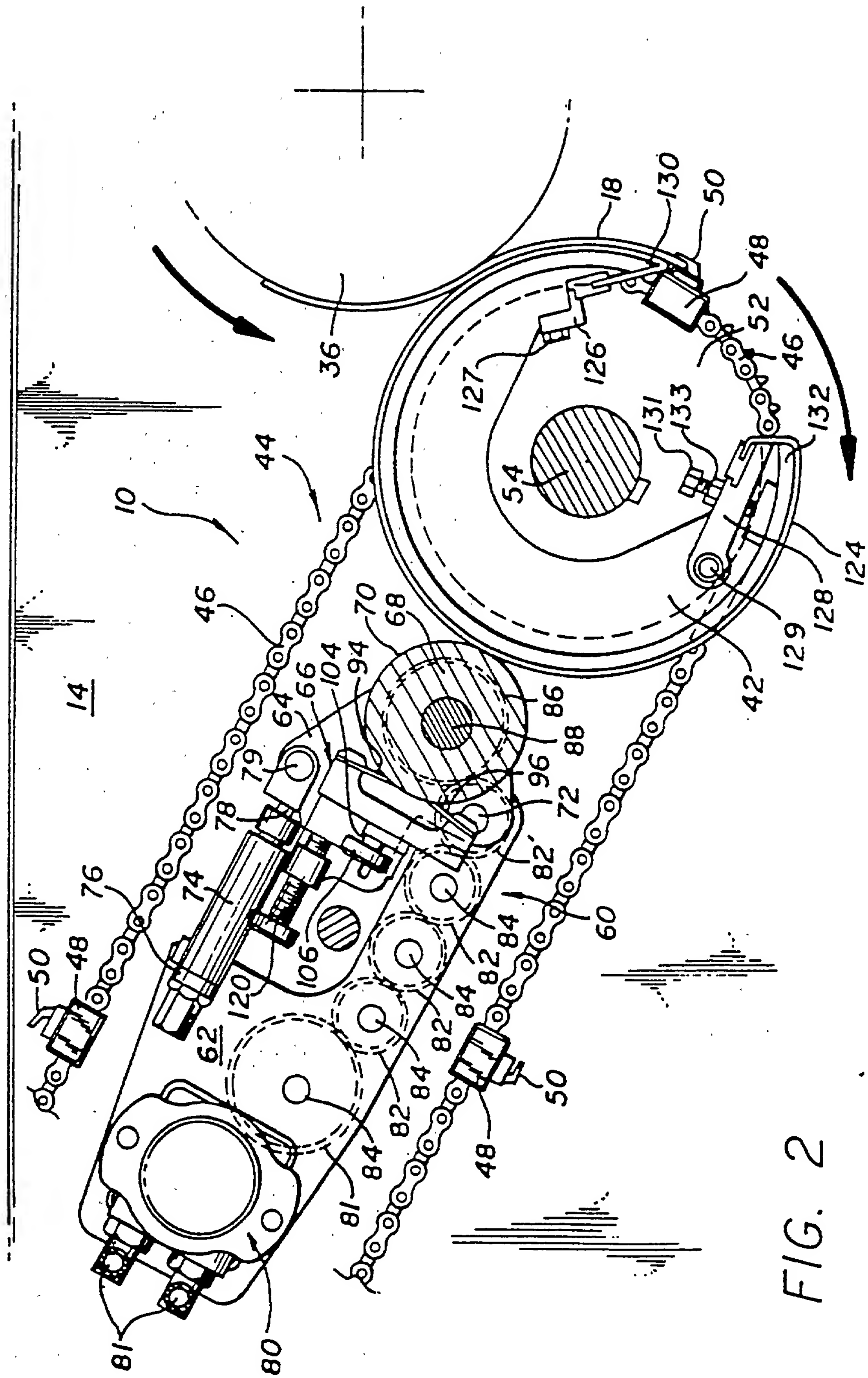


FIG. 2

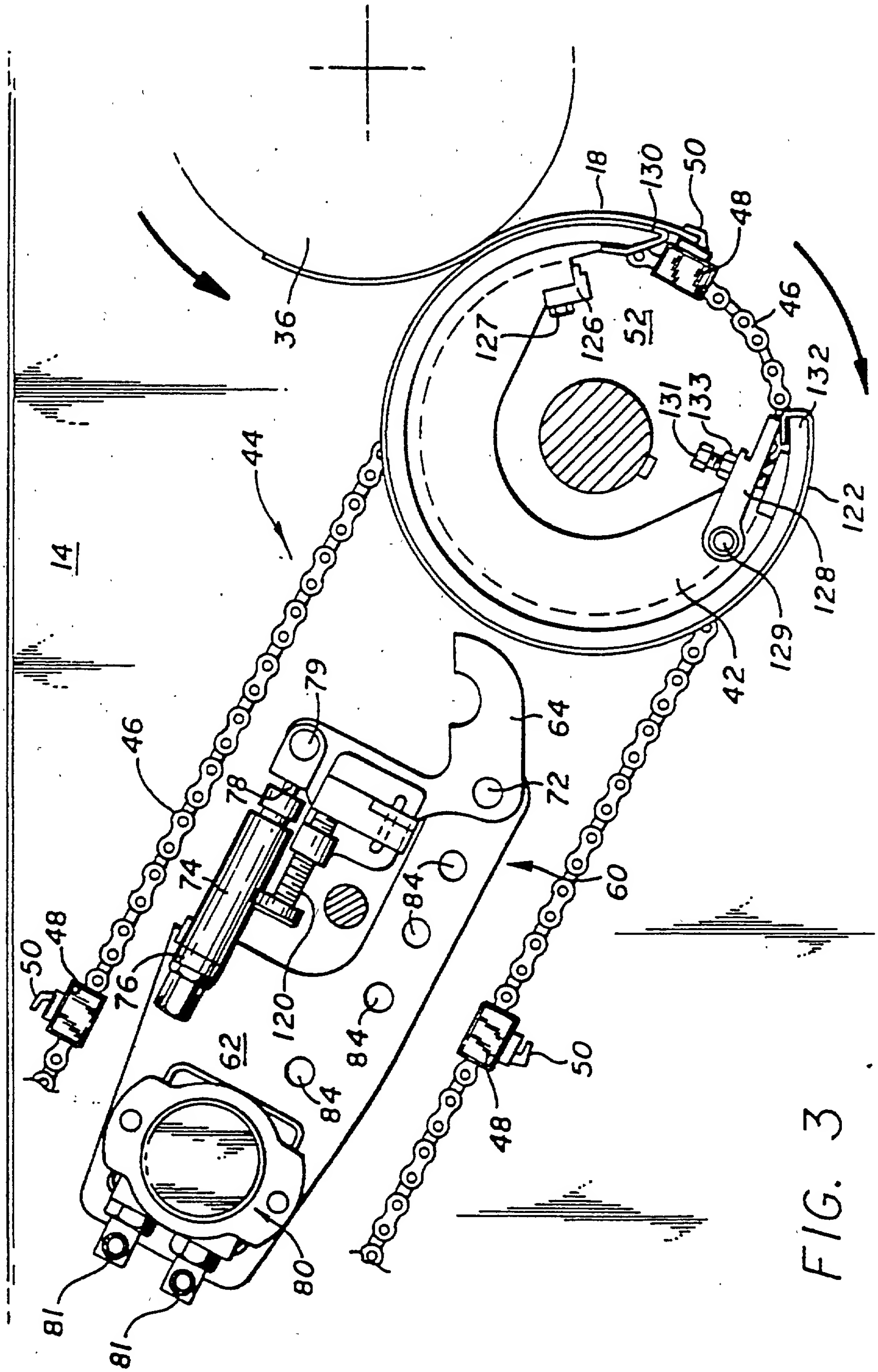
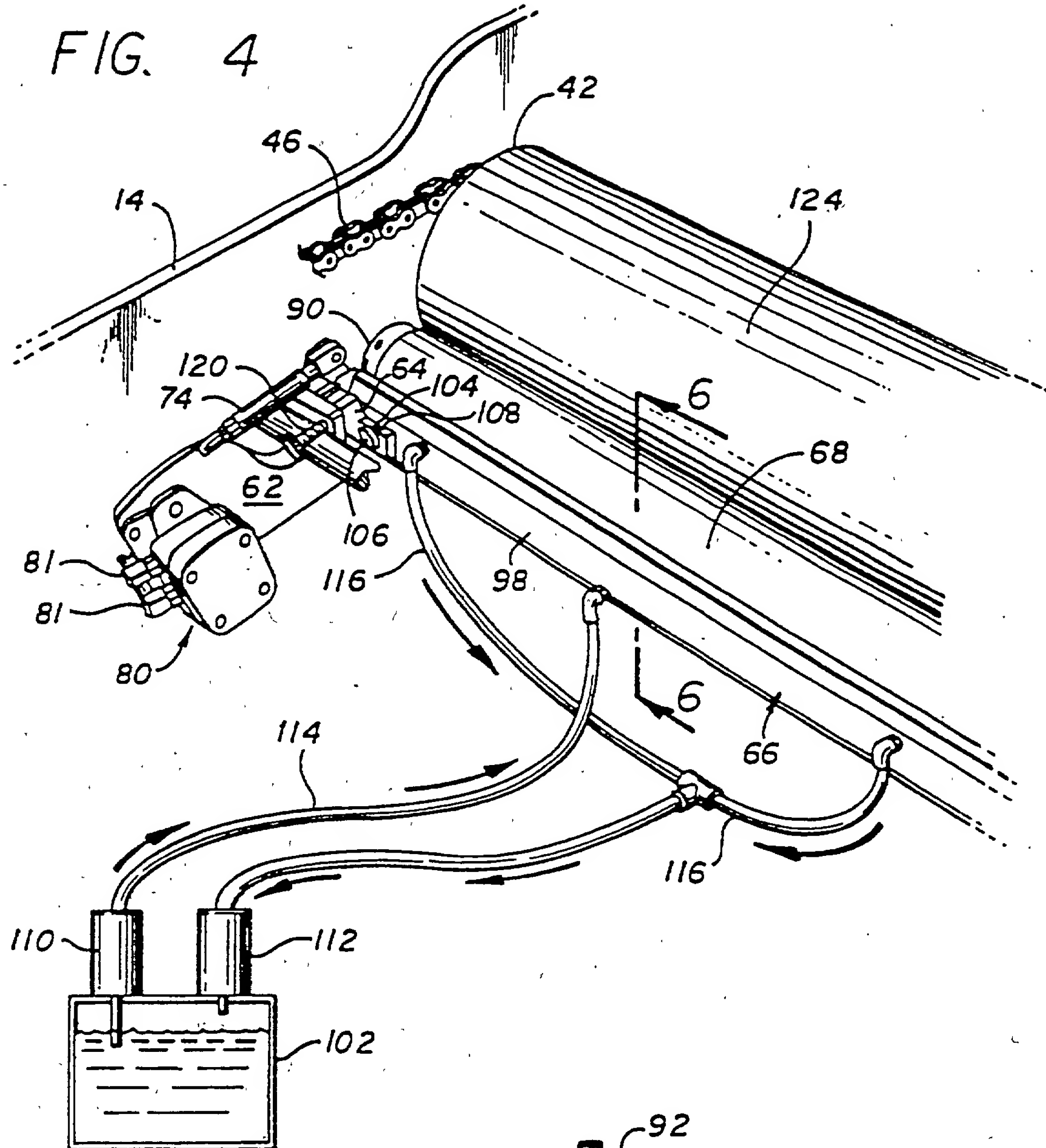


FIG. 3

FIG. 4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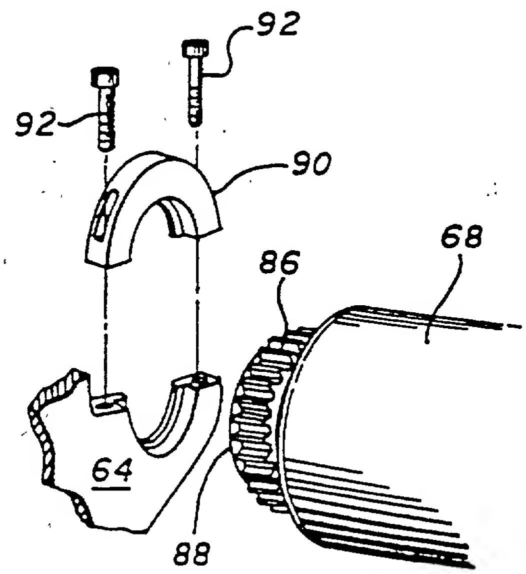
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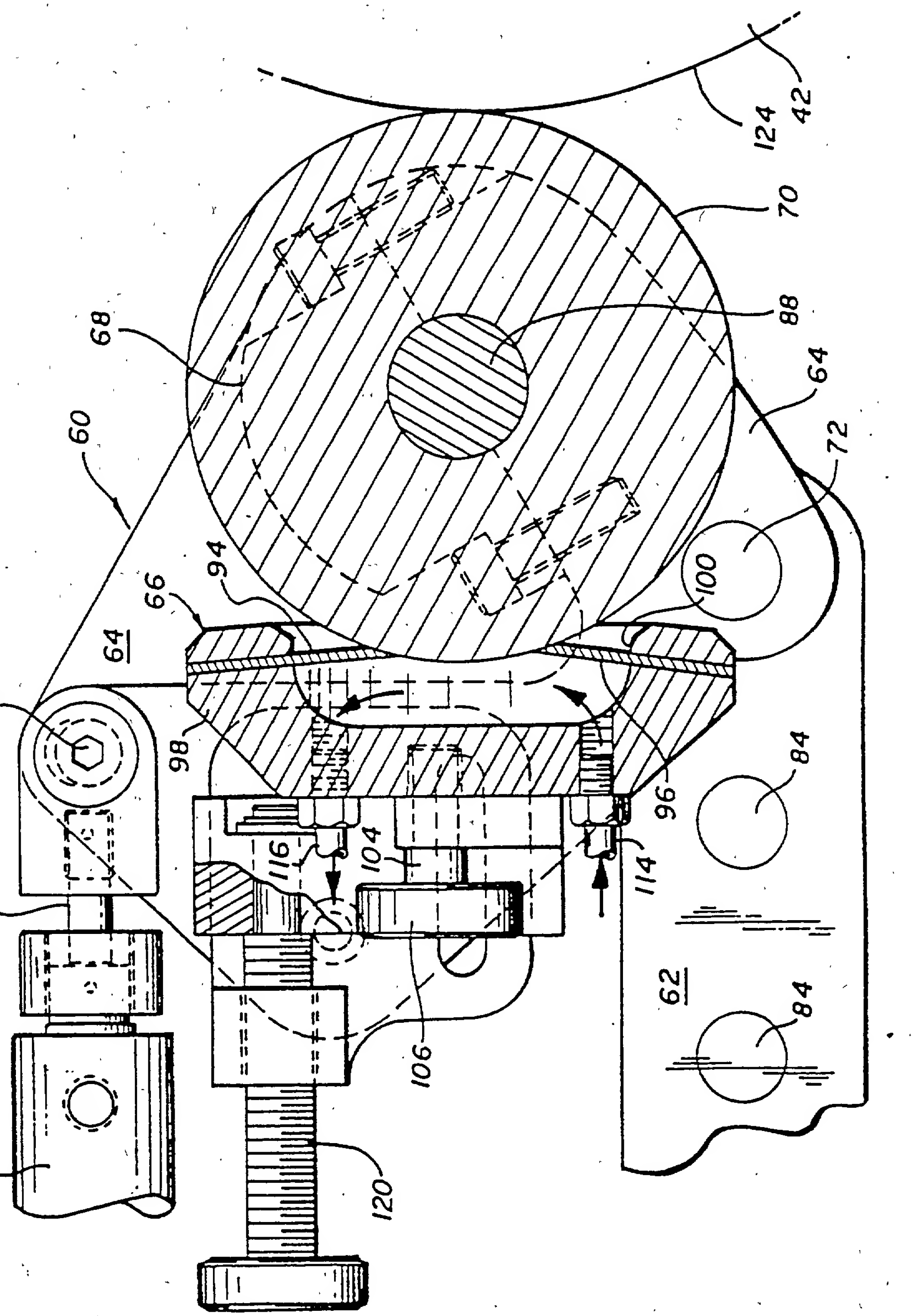
FIG. 5

FIG. 6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COATING APPARATUS FOR SHEET-FED, OFFSET ROTARY PRINTING PRESSES

BACKGROUND OF THE INVENTION

This invention relates to sheet-fed, offset rotary printing presses, and more particularly, to a new and improved apparatus for the in-line application of protective and decorative coatings to the printed surface of freshly printed sheets.

Conventional sheet-fed, offset rotary printing presses typically include one or more printing stations through which individual sheets are fed and printed with wet ink. After final printing, the sheets are fed by a delivery conveyor system to the delivery end of the press where the freshly printed sheets are collected and stacked. In a typical sheet-fed, offset rotary printing press such as the Heidelberg Speedmaster line of presses, the delivery conveyor system includes a pair of endless gripper chains carrying laterally spaced gripper bars and grippers which are used to grip and pull freshly printed sheets from the impression cylinder and convey the sheets toward the sheet delivery stacker. The gripper chains are driven in precisely timed relation to the impression cylinder by gripper chain sprocket wheels laterally spaced between a delivery drive shaft mounted on opposite sides of the press frame, the delivery drive shaft being mechanically coupled by gears for synchronous rotation with the impression cylinder.

Since the inks used with offset type printing presses typically remain wet and tacky for some time after printing, special precautions must be taken to insure that the wet inked surface of the freshly printed sheets are not marked or smeared as the sheets are transferred from one printing station to another, and through the delivery system to the sheet delivery stacker. One system for insuring that the freshly printed sheets are not marked or smeared during transfer is the transfer or delivery cylinder system marketed by Printing Research, Inc., of Dallas, Texas under its registered trademark "SUPER BLUE" That system, which is made and sold under license, is made in accordance with and operates as described in U.S. Pat. No. 4,402,267, issued Sep. 6, 1983 to Howard W. DeMoore, the disclosure of which is incorporated herein by this reference. In that system, marking and marring of freshly printed sheets is prevented by employing transfer or delivery cylinders provided with a coating of friction reducing material such as PTFE (Teflon) over which are loosely mounted fabric covers, referred to in the trade as "nets", and which support the wet ink side of the freshly printed sheets as they are pulled from the impression cylinder. Typically, in a multi-color press employing the "SUPER BLUE" cylinder system, each transfer cylinder for conveying the freshly printed sheets from one printing station to the next is supplied with a "SUPER BLUE" transfer cylinder system, and the delivery cylinder for conveying the sheets from the last printing station to the sheet delivery stacker is supplied with a "SUPER BLUE" delivery cylinder system. As used hereinafter, the term "net type cylinder" is intended to refer to cylinders having fabric nets disposed over the support surface, such as of the general type disclosed in the aforementioned DeMoore U.S. Pat. No. 4,402,267 and exemplified by the "SUPER BLUE" cylinder system.

Another system which can be used to prevent marking and smearing of the freshly printed sheets is that disclosed in U.S. application Ser. No. 07/630,308 filed Dec. 18, 1990 entitled Vacuum Transfer Apparatus for Sheet-Fed Printing Presses now U.S. Pat. No. 5,127,329. That application, the disclosure of which is also incorporated herein by reference, discloses an apparatus which can be employed to draw the unprinted side of a freshly printed sheet into engagement with rollers which support the sheet on the unprinted side during transfer or delivery of the sheet from the impression cylinder after printing so that the wet ink on the freshly printed sheet does not come in contact with other apparatus in the press. The vacuum transfer apparatus disclosed in that application can be used as an alternative to the net type cylinder system disclosed in the aforementioned DeMoore patent, or when used in a perfecting press, as a supplement to that system, the vacuum transfer apparatus being primarily intended for use when only one-sided sheet printing is being performed by the press, and the net type cylinder system being used when the press is operating in the perfector mode with two-sided sheet printing.

In some printing applications, it is desirable that the press be capable of applying a protective and/or decorative coating over all or a portion of the surface of the printed sheets. Such coatings typically are formed of a UV-curable or water-soluble resin applied as a liquid solution or emulsion by an applicator roller over the freshly printed sheets to protect the ink and improve the appearance of the sheets. Use of such coatings is particularly desirable when decorative or protective finishes are required such as in the production of posters, record jackets, brochures, magazines, folding cartons and the like. In cases where a coating is to be applied, the coating operation is carried out after the final ink printing has been performed, most desirably by an in-line coating application, rather than as a separate step after the printed sheets have been delivered to the sheet delivery stacker.

Various suggestions have been made for applying the coating as an in-line press operation by using the final printing station of the press as the coating application station. For example, in U.S. Pat. Nos. 4,270,483, 4,685,414, and 4,779,557 there are disclosed coating apparatus which can be moved into position to allow the blanket cylinder of the last printing station of a press to be used to apply a coating material to the sheets. In U.S. Pat. No. 4,796,556 there is disclosed a coating apparatus which can be selectively moved between the blanket cylinder or the plate cylinder of the last printing station of the press so that that station can be used as a coating station for the press. However, when coating apparatus of these types are used, the last printing station can not be used to apply ink to the sheets, but rather can only be used for the coating operation. Thus, with these types of in-line press coating apparatus, the press loses the capability of printing its full range of colors since the last printing station is converted to a coating station.

Suggestions for overcoming the problem of the loss of a printing station when coating is desired have also been made, such as that set forth in U.S. Pat. Nos. 4,934,305 which discloses a coating apparatus having a separate timed applicator roller positioned to apply the coating material to the printed sheet while the sheet is on the last impression cylinder of the press. This is said to allow the last printing station to be operated simultaneously as both an ink application station and a coating

station so that no loss of press printing unit capability results. Another approach to providing a coating station without loosing the printing capabilities of the last printing station is to provide a totally separate coating unit down stream of the last printing station so that the coating is applied to the sheets after final printing and before the sheets have reached the sheet delivery stacker. Such an approach is suggested in U.S. Pat. Nos. 4,399,767 and 4,706,601. While each of these suggestions provide coating stations which allow the final printing station to continue to be used for printing, they each suffer from the disadvantages of requiring the provision of separately driven coating applicator rollers and apparatus which must be precisely timed in relation to the movement of the sheet to be coated so as to insure precise registration between application of the coating material and the printed sheet. The provision of separate timed applicator rollers require that the presses be modified to provide sufficient space within the presses to accommodate the added coating apparatus or to increase the length of the presses, and require additional and complex drive connections with the press drive system to achieve the required precise speed correlation between the sheets and the applicator rollers. Such modifications can be both expensive and cumbersome to install and maintain.

Thus, there exists a need for a new and improved in-line apparatus for use in a sheet-fed, offset rotary printing press to selectively apply a protective and/or decorative coating to the printed surface of freshly printed sheets which allows the final press printing station to continue to be used as a printing station, yet which does not require any substantial press modification or the addition of a separate timed applicator roller. As will be explained in more detail hereinafter, the present invention solves this need in an novel and unobvious manner.

SUMMARY OF THE INVENTION

The present invention provides a new and improved in-line apparatus for selectively applying a protective and/or decorative coating to the surface of freshly printed sheets in a sheet-fed, offset rotary printing press which is highly reliable and effective in use, yet which does not require any expensive or substantial press modification or result in any impairment of normal press operating capability. The present invention enables the press to be used to selectively apply the coating material to the freshly printed sheets as the sheets are conveyed from the impression cylinder of the last printing station of the press toward the sheet delivery stacker by utilizing a delivery cylinder mounted to the existing press delivery drive shaft to perform the dual function of a coating material applicator roller and a sheet delivery cylinder so that no modification of the press is required to enable the press to be used for either coating or noncoating operation, and without impairment of any normal press operations.

More specifically, the present invention is intended for use in a sheet-fed, offset rotary printing press of the type having at least one printing station which includes a blanket cylinder and an impression cylinder disposed for printing ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets off the impression cylinder and transporting the sheets toward the press sheet delivery stacker. For use of the present invention, the press must include a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder, and which is driven in timed synchronous relation with the impression cylinder.

In accordance with the invention, a delivery cylinder is mounted to the delivery drive shaft and provided with a coating blanket disposed over the peripheral outer surface of the cylinder, and adapted to engage and support the wet ink side of a freshly printed sheet. A coating apparatus including a supply of liquid coating material and a pick-up roller disposed to receive coating material from the supply, is mounted to the press and operable to permit the pick-up roller to be moved into engagement with the delivery cylinder so that coating material on the pick-up roller is transferred to the coating blanket of the delivery cylinder and then to the freshly printed sheet.

Preferably, the coating apparatus is mounted to the press downstream of the delivery drive shaft, and includes means to selectively move the pick-up roller into and out of engagement with the delivery cylinder. When the pick-up roller is not in the operable position in engagement with the delivery cylinder, the delivery cylinder can be used for conventional noncoating sheet delivery by removing the coating blanket and, preferably, replacing the coating blanket with a fabric net such as of the net type cylinder system previously described. To convert to a coating operation, the coating blanket is attached to the delivery cylinder and, depending upon the thickness of the sheets to be printed, packed with suitable packing sheets to increase the effective diameter of the cylinder so that pressure is applied to the freshly printed sheets against the impression cylinder by the coating blanket covered delivery cylinder. The pick-up roller is then moved to the operative position engaged with the delivery cylinder so that as freshly printed sheets are pulled by the delivery conveyor from the impression cylinder around the delivery cylinder, coating material applied to the delivery cylinder by the pick-up roller is transferred to the freshly printed sheets in the nip between the delivery cylinder and the impression cylinder.

Since the delivery cylinder is driven by the delivery drive shaft in precise timed relation with the impression cylinder, exact registration between the application of coating material and the printed sheet is assured. Further, since the coating of the freshly printed sheets is carried out through use of a delivery cylinder mounted to the existing press delivery drive shaft, no substantial press modifications are required, and the press can be quickly and easily converted between coating and noncoating operation with no loss of printing capability of the final printing station.

Many other features and advantages of the present invention will become more apparent from the following detailed description take in conjunction with the accompanying drawings which disclose, by way of example, the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side elevational view of a sheet-fed, offset rotary printing press having a coating apparatus embodying the present invention;

FIG. 2 is an enlarged fragmentary side elevational view taken substantially within the circular area designated "2" in FIG. 1 and showing the coating apparatus of the present invention during coating operation;

FIG. 3 is a side elevational view similar to FIG. 2, but showing the coating apparatus in the inoperative posi-

tion with the coating pick-up roller and reservoir removed, and the blanket covering over the delivery cylinder replaced with a fabric net for non-coating printing;

FIG. 4 is an enlarged fragmentary perspective view showing one side of the coating apparatus mounted in the press and illustrating the fluid path of coating material from a supply tank to the reservoir of the coating unit;

FIG. 5 is an enlarged fragmentary perspective view illustrating the end mounting of the coating pick-up roller to its support bracket; and

FIG. 6 is an enlarged fragmentary sectional view taken substantially along the lines 6—6 of FIG. 4.

DETAILED DESCRIPTION OF PRESENTLY PREFERRED EMBODIMENT

As shown in the exemplary drawings, the present invention is embodied in a new and improved in-line apparatus, herein generally designated 10, for selective use in applying a protective and/or decorative coating to the freshly printed surface of sheets printed in a sheet-fed, offset rotary printing press, herein generally designated 12. In this instance, as shown in FIG. 1, the coating apparatus 10 is illustrated as installed in a four color printing press 12, such as that manufactured by Heidelberger Druckmaschinen AG of the Federal Republic of Germany under its designation "Heidelberg Speedmaster 102V (40")," and which includes a press frame 14 coupled at one end, herein the right end, with a sheet feeder 16 from which sheets, herein designated 18, are individually and sequentially fed into the press, and at the opposite end, with a sheet delivery stacker 20 in which the finally printed sheets are collected and stacked. Interposed between the sheet feeder 16 and the sheet delivery stacker 20 are four substantially identical sheet printing stations 22, 24, 26 and 28 which can print different color inks onto the sheets as they are moved through the press 10.

As illustrated, each of the printing stations 22, 24, 26 and 28 is substantially identical and of conventional design, herein including a sheet feed cylinder 30, a plate cylinder 32, a blanket cylinder 34 and an impression cylinder 36, with each of the first three printing stations 22, 24, and 26 having a transfer cylinder 38 disposed to withdraw the freshly printed sheets from the adjacent impression cylinder and transfer the freshly printed sheets to the next printing station via a transfer drum 40. The final printing station 28 herein is shown as equipped with a delivery cylinder 42 which functions to support the printed sheet 18 as it is moved from the final impression cylinder 36 by a delivery conveyor system, generally designated 44, to the sheet delivery stacker 20.

The delivery conveyor system 44 herein is of conventional design and includes a pair of endless delivery gripper chains 46, only one of which is shown in the drawings, carrying at regular spaced locations along the chains, laterally disposed gripper bars 48 having gripper elements 50 used to grip the leading edge of a sheet 18 after it leaves the nip between the delivery cylinder 42 and impression cylinder 36 of the last printing station 28. As the leading edge of the sheet 18 is gripped by the grippers 50, the delivery chains 46 pull the sheet away from the impression cylinder 36 and convey the freshly printed sheet to the sheet delivery stacker 20 where the grippers release the finally printed sheet. The endless delivery chains 46 are driven in synchronous timed relation to the impression cylinder 36 by sprocket wheels 52 fixed adjacent the lateral ends of a delivery drive shaft 54 which has a mechanically geared coupling (not shown) through the press drive system to the impression cylinder. The delivery drive shaft 54 extends laterally between the sides of the press frame 14 adjacent the impression cylinder 36 of the last printing station 28, and is disposed to be parallel with the axis of the impression cylinder. In this instance, the delivery cylinder 42, which is constructed to allow adjustments in diameter by suitable means, is fixedly mounted to the delivery drive shaft 54 so that the delivery cylinder is also rotated in precise timed relation to the impression cylinder.

Preferably, each of the transfer cylinders 38 is equipped with an anti-marking system such as the aforementioned net type transfer cylinder system or the press 12 can be supplied in the transfer positions with vacuum transfer systems of the type disclosed in the above-identified copending U.S. application Ser. No. 07/630,308 filed Dec. 18, 1990, although as will become more apparent hereinafter, the use of such transfer systems is not required for the present invention and other types of transfer systems can be used. For reasons that will become more apparent hereinafter, for most effective use of the present invention, however, the delivery cylinder 42 should be of the type which employs the "SUPER BLUE" delivery cylinder system, or, as an alternative, should employ in the delivery position, a vacuum transfer system such as disclosed in the above-identified copending U.S. application Ser. No. 07/630,308.

In this respect, it is important to note that when the freshly printed sheets 18 are conveyed away from the impression cylinder 36 of the final printing station 28 by the gripper 50 carried by the delivery chains 46, the wet inked surfaces of the sheets face the delivery drive shaft 54 and the sheets must be supported such that the ink is not marked or smeared as the sheets are transferred. Typically, such support is provided by skeleton wheels or cylinders mounted to the press delivery drive shaft 54, or as is now more commonly used, net type delivery cylinders such as of the "SUPER BLUE" delivery cylinder system type disclosed in the aforementioned DeMoore patent. More recently, vacuum transfer apparatus of the type disclosed in the aforementioned copending U.S. application Ser. No. 07/630,308 have been used in place of delivery cylinders or skeleton wheels to pull the unprinted side of the sheet away from the delivery drive shaft 54 so that the wet ink surface of the sheets do not come into contact with any press apparatus. It has been found, however, that when a protective or decorative coating material is applied to the wet ink surface of the sheets, the coating protects the wet ink against marking and smearing such that the coating applicator roller itself can be used to support the wet inked surface of the sheets without fear of damage to the freshly printed surface.

In accordance with the present invention, the in-line coating apparatus 10 for selectively applying the protective or decorative coating to the sheets 18 enables the press 12 to be operated in the normal manner without the loss of the final printing station 28, and without requiring any substantial press modifications by employing the existing press delivery drive shaft 54 as the mounting location for the coating applicator roller. In presses 12 utilizing a net type delivery cylinder system, that system can be quickly and easily converted to perform the dual function of being a coating applicator roller and a delivery cylinder. In presses having other

types of delivery systems such as skeleton wheels mounted on the delivery drive shaft 54 or a vacuum transfer apparatus as disclosed in the aforementioned copending U.S. application Ser. No. 07/630,308, conversion to a coating operation can be quickly and easily achieved by mounting on the press delivery drive shaft in place of the skeleton wheels or in addition to the vacuum transfer apparatus, a suitable support cylinder capable of performing the combined function of a coating applicator roller and a delivery cylinder 42. Typically, such a support cylinder will have a diameter which provides no more than about a 0.090 inch clearance between the cylinder support surface and the adjacent impression cylinder 36. By utilizing the delivery cylinder 42 mounted on the delivery drive shaft 54 to also act as a coating applicator roller, the present invention insures that the coating will be applied to the printed sheet 18 in precise timed registration, and will permit the press to be operated with its full range of printing stations, yet allow fast, simple and convenient change-over from coating to noncoating operations, and vice versa, with a minimum of press down time.

Toward these ends, the coating apparatus 10 of the present invention includes a relatively simple, positive acting and economical coating unit, generally designated 60, mounted to the press frame 14 down stream of the delivery drive shaft 54 and positioned to selectively supply coating material to the support surface of a delivery cylinder 42 mounted on the delivery drive shaft. As best can be seen in FIGS. 2, 4 and 6, the coating unit 60 herein comprises a pair of side frames 62, only one of which is shown, it being understood that the other side frame is substantially the same as that of the side frame illustrated, attached to each side of the press frame 14. Pivotally mounted to one end of each of the side frames 62 is a support bracket 64 carrying one end of a coating material reservoir 66 and cooperating coating material pick-up roller 68 each disposed to extend laterally across the press 12 parallel with the delivery drive shaft 54. The coating unit 60 is mounted between the upper and lower runs of the delivery chains 46 down stream of the delivery drive shaft 54, and positioned so that the outer peripheral surface 70 of the pick-up roller 68 can be frictionally engaged with the support surface of a delivery cylinder 42 mounted on the delivery drive shaft.

As best seen in FIGS. 2 through 4, the support bracket 64 is pivotally attached to the end of the side frame 62 by a shaft 72 disposed at the lower end portion of the bracket, and can be pivoted about the shaft by an extensible cylinder 74, herein shown as a hydraulic cylinder, one end 76 of which is secured such as by welding to the side frame, and the opposite end 78 of which is coupled through a pivot shaft 79 to the upper end portion of the bracket. By extending or retracting the cylinder 74, the extent of frictional engagement of the pick-up roller 68 with the surface of the delivery cylinder 42 can be controlled, and the pick-up roller can be completely disengaged from the delivery cylinder.

The coating pick-up roller 68, which can be of conventional design and preferably one such as the Anilox rollers manufactured by A.R.C. International of Charlotte, N.C., and sold under the name "PRINTMASTER" having an engraved ceramic or chrome outer peripheral surface 70, is designed to pick up a predetermined uniform thickness of coating material from the reservoir 66, and then uniformly transfer the coating to the support surface of the delivery cylinder 42. To effect rotation of the pick-up roller 68, a suitable motor 80, herein a hydraulic motor, is attached to one of the side frames 62 and coupled to a suitable hydraulic fluid source (not shown) through fittings 81. Attached to the output of the motor 80 is an output gear which is drivingly coupled through a reduction gear 81 and a series of idler gears 82 each mounted on stub axles 84, to a drive gear 86 attached to the end of a shaft 88 on which the pick-up roller 68 is concentrically mounted. The shaft 88 of the pick-up roller 68 is, in turn, journaled at each end to the brackets 64 through a releasable semicircular collar 90 (see FIG. 5) attached by bolts 92 to the bracket. Herein, the axle of the terminal idler gear, designated 82', also serves as the shaft 72 for pivotally mounting the support bracket 64 to the side frame 62 so that when the bracket is rotated about the shaft, the terminal idler gear remains engaged with the drive gear 86 of the pick-up roller 68.

In this instance, as best as can be seen in FIG. 6, the pick-up roller 68 has a portion which projects laterally into the reservoir 66 containing the supply of coating material, and a pair of upper and lower inclined doctor blades 94 and 96 attached to the reservoir engage the roller surface to meter the coating material picked up from the reservoir by the etched surface 70 of the roller. The reservoir 66 herein is formed by an elongated, generally rectangular housing 98 having a generally C-shaped cross-section with a laterally extending opening 100 along one side facing the pick-up roller 68, and is supplied with coating material from a supply tank 102 disposed in a remote location within or near the press 12. Preferably, the reservoir 66 is removably attached to the brackets 64, herein by bolts 104 having enlarged, knurled heads 106, and which can be threaded through slots 108 formed in the brackets to clamp the reservoir in place on the brackets.

To insure that an adequate supply of coating material is always present within the reservoir 66 and to prevent coagulation and clogging of the doctor blades 94 and 96 by the aqueous coating material, the coating material is circulated through the reservoir, herein by two substantially identical pumps 110 and 112, one of which pumps coating material from the supply tank 102 via a supply line 114 to the bottom of the reservoir, and the other of which acts to provide suction to a pair of return lines 116 coupled adjacent the top of the reservoir for withdrawing unused coating material from the reservoir. By circulating the coating material from the supply tank 102 at a greater rate than the rate of withdrawal of material by the pick-up roller 68, a substantially constant supply of coating material will always be present within the reservoir 66.

In this instance, the general arrangement of the pick-up roller 68, doctor blades 94 and 96, and reservoir 66 is substantially like that disclosed in U.S. Pat. No. 4,821,672 entitled DOCTOR BLADE ASSEMBLY WITH ROTARY END SEALS AND INTERCHANGEABLE HEADS", the disclosure of which can be reviewed for details concerning the structure and operation of a pick-up roller and reservoir usable with the present invention.

Once the coating unit 60 has been installed in a press 12, which basically only requires that the side frames 62 be attached, such as with bolts, to the sides of the press frame 14, and the hydraulic motor 80 be coupled with a suitable hydraulic source, the press can be quickly and easily converted to the coating mode. In presses 12 already supplied with a net type delivery cylinder sys-

tem, to convert to a coating operation, all that is necessary is that the fabric net material (designated 122 in FIG. 3) normally used over the support surface of the net type delivery cylinder during noncoating press operations, be removed and replaced with a coating blanket 124 capable of transferring coating material deposited thereon onto the printed sheets. Typically, such a blanket 124 can be formed as a rubber covering such as used for the covering surface of the conventional blanket cylinders 34 of the press 12. In presses 12 having conventional skeleton wheels or a vacuum transfer type apparatus such as that of the aforementioned copending U.S. application Ser. No. 07/630,308, a suitable delivery cylinder 42 can be fixed to the delivery drive shaft 54 and a similar coating blanket 124 applied thereto over the cylinder surface.

It is important to note that during nonprinting operations, the net type delivery cylinder 42 does not engage the surface of the impression cylinder 36 during sheet delivery. However, when used as a coating applicator roller during coating operations, the effective diameter of the delivery cylinder 42 must be increased so that the coating blanket 124 presses the sheet 18 against the surface of the impression cylinder 36, as shown in FIG. 2. To increase the effective diameter of the delivery cylinder 42, the thickness of the coating blanket 124 applied over the support surface of the delivery cylinder 42 can be selected to correspond with the thickness of the sheets 18 to be printed, or suitable packing sheets, such as paper sheets (not shown) of the type conventionally used in conjunction with press blanket cylinders 34, can be interposed between the delivery cylinder and the coating blanket.

While any suitable means can be used to attached the coating blanket 124 to the support surface of the delivery cylinder 42, in this instance, as shown in FIGS. 2 and 3, the delivery cylinder is supplied with clamps 126 attached by bolts 127 to the cylinder adjacent the leading edge 130 to secure the leading edge of the coating blanket 124 to the cylinder, and adjustable tensioning clamps 128 are provided adjacent the cylinder trailing edge 132 for securing the trailing edge of the blanket to the cylinder. However, the tensioning claims 128 are pivotally mounted at one end by a pin 129 to the cylinder 42, and the blanket tension is adjusted through a bolt 131 and nut 133 arrangement. Depending upon the thickness of the sheets 18 to be printed and coated by the press 12, one or more layers of packing paper or the like may be interposed between the support surface of the delivery cylinder 42 and the coating blanket 124 to increase the effective diameter of the cylinder. Provision of the tensioning clamps 128 for attaching the coating blanket 124 to the leading edge 132 of the delivery cylinder 42 allows for such control and adjustment.

Once installed, the coating unit 60 can remain in position even though the press 12 is operated in the non-coating mode. In this respect, when the coating unit 60 is not in operation, the extensible cylinder 74 can be actuated to pivot the support brackets 64 carrying the pick-up roller 68 and reservoir 66 about the shaft 72 and away from the delivery cylinder 42, thus rendering the coating unit inoperative. This then also frees the pick-up roller 68 and reservoir 66 for fast and easy removal from the coating unit 60 for cleaning, service or replacement. To remove the pick-up roller 68, the coating material is drained from the reservoir 66, and the pressure exerted by the doctor blades 94 and 96 against the roller is released, therein through operation of a pressure adjustment screw 120 attached to the reservoir, and the bolts 92 and collars 90 are removed, thereby permitting the pick-up roller to be lifted from the coating unit 60. To remove the reservoir 66, all that need be done is to release the mounting bolts 104 securing the reservoir to the brackets 64. With the coating unit 60 moved by the extensible cylinder 74 to the inoperative position, the delivery cylinder 42 can be converted for normal delivery cylinder operation simply by removing the coating blanket 124 from the delivery cylinder 42 and replacing the blanket with a fabric net 122. Alternatively, if a vacuum transfer apparatus such as described in the aforementioned copending U.S. application Ser. No. 07/630,308 is installed in the press 12, that apparatus can be activated to deliver sheets from the impression cylinder 36 without effecting any delivery cylinder change since the freshly printed side of the sheets will not come into contact with the delivery cylinder.

In a typical noncoating operation of the press 12 with the coating apparatus 10 installed, the coating unit 60 will be in the inoperative position. In that situation and with a net type delivery cylinder 42 installed, the delivery cylinder will be covered with the fabric net 122 so that the delivery cylinder operates in the normal manner with the wet ink side of the freshly printed sheets 18 being supported by the net covered surface of the delivery cylinder. Should the press 12 include a vacuum transfer apparatus such as disclosed in the aforementioned copending U.S. application Ser. No. 07/630,308, the delivery cylinder 42 can remain on the delivery drive shaft 54, with or without a fabric net 122, depending upon whether or not the press is used for perfector printing.

When it is desired to convert to the coating mode of operation, the press 12 is stopped just long enough to replace the fabric net 122 on the delivery cylinder 42 with the coating blanket 124 packed to the required extent necessary for providing the proper pressure to effect coating of the sheet thickness to be printed. Thereafter, the pumps 110 and 112 are activated and the press 12 re-started. The extensible cylinder 74 can then be activated to control the pressure of the pick-up roller 68 against the delivery cylinder 42 to obtain the desired application of coating material to the freshly printed sheets 18.

Notably, with the coating apparatus 10 of the present invention, no timing adjustments between the delivery cylinder 42 and the impression cylinder 36 are required to achieve and maintain precise registration between application of the coating material and the printed surface of the sheets 18. Further, the coating unit 60 permits a wide range of coating weights to be applied to the printed sheets 18 by quickly and easily changing pick-up rollers 68 from those designed to produce a very light coating application to those designed to produce a very thick coating application can be used.

From the foregoing, it should be apparent that the coating apparatus 10 of the present invention provides a highly reliable, effective and economical in-line apparatus for selectively applying coating material to the freshly printed sheets 18 in a sheet-fed, offset rotary printing press 12 which allows the final printing station to continue to be used as a print station, yet which does not require any substantial press modification or the addition of a separate timed applicator roller. While a particular form of the present invention has been illustrated and described, it should be apparent that varia-

tions and modifications therein can be made without departing from the spirit and scope of the invention.

We claim:

1. In a sheet-fed, offset rotary printing press of the type including at least one printing station having a blanket cylinder and an impression cylinder disposed for printing ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery conveyor system including a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder and driven in timed synchronous relation with the impression cylinder, the improvement comprising:

a delivery cylinder mounted to said delivery drive shaft and having an outer peripheral support surface adapted to engage and support a sheet being transported by said delivery conveyor system;

a coating apparatus including a supply of liquid coating material, a rotatable pick-up roller having an outer peripheral surface of substantially cylindrical shape, and means for applying a coating of liquid coating material from said supply onto said outer peripheral surface of said pick-up roller; and

means for mounting said coating apparatus to the press adjacent said delivery cylinder including selectively operable means for moving said pick-up roller between a first operable position with a portion of said peripheral surface of said pick-up roller engaged with said support surface of said delivery cylinder, and a second inoperable position with said peripheral surface out of engagement with said support surface of said delivery cylinder, whereby when said pick-up roller is in said first operable position, liquid coating material from said supply applied onto said peripheral surface of said pick-up roller is transferred to said support surface of said delivery cylinder and to said freshly printed sheet.

2. The improvement as set forth in claim 1 wherein said delivery cylinder includes a coating blanket disposed over said peripheral support surface.

3. The improvement as set forth in claim 1 wherein said delivery cylinder includes a removable coating blanket disposed over said peripheral support surface when said pick-up roller is in said first operable position.

4. The improvement as set forth in claim 3 wherein said coating blanket has a rubber outer surface.

5. The improvement as set forth in claim 3 wherein said delivery cylinder includes a fabric net disposed over said peripheral support surface when said pick-up roller is in said second inoperable position.

6. The improvement as set forth in claim 1 wherein said coating apparatus includes an elongated reservoir containing said supply of liquid coating material, said reservoir being disposed to extend parallel with said pick-up roller with a portion of said peripheral surface extending into said reservoir in contact with liquid coating material contained therein, and at least one doctor blade attached to said reservoir and engaging said peripheral surface, said doctor blade acting to limit the amount of liquid coating material applied onto said peripheral surface from said reservoir.

7. The improvement as set forth in claim 6 wherein said reservoir and said pick-up roller are movably coupled to said press and said selectively operable means includes an extensible cylinder coupled between said reservoir and said press and operable to move said reservoir and said pick-up roller between said first and second positions.

8. The improvement as set forth in claim 7 wherein said pick-up roller is rotatably driven by a motor attached to said coating apparatus.

9. The improvement as set forth in claim 8 wherein said delivery cylinder includes a rubber coating blanket disposed over said peripheral support surface when said pick-up roller is in said first operable position, and includes a fabric net disposed over said peripheral support surface when said pick-up roller is in said second inoperable position.

10. The improvement as set forth in claim 9 wherein said coating apparatus is mounted to said press downstream of said delivery drive shaft in the direction of travel of said sheets during transport by said delivery conveyor system.

11. The improvement as set forth in claim 1 wherein said mounting means includes first and second side frames mounted on said press, a support shaft mounted on and extending between said first and second side frames, a support bracket attached to said coating apparatus and movably coupled to said support shaft for pivotal movement between said first and second positions, and said selectively operable means includes an extensible cylinder coupled between said coating apparatus and said support bracket and operable to move said coating apparatus toward and away from said delivery cylinder.

12. In a sheet-fed, offset rotary printing press of the type including at least one printing station having a blanket cylinder and an impression cylinder disposed for printing wet ink onto sheets passing therebetween, and a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery conveyor system comprising a pair of endless gripper chains disposed on opposite sides of the press and supporting therebetween gripper bars and grippers spaced along the chains, the gripper chains being driven in timed synchronous relation with the impression cylinder by laterally spaced sprocket wheels mounted on opposite ends of a delivery drive shaft disposed adjacent to and extending parallel with the impression cylinder, the improvement comprising:

a delivery cylinder mounted to said delivery drive shaft between said sprocket wheels and having an outer peripheral support surface covered by a removable coating blanket adapted to engage and support the wet ink side of a sheet being transported by said gripper bars;

a coating apparatus including a supply of liquid coating material, a rotatable pick-up roller having an outer peripheral surface of substantially cylindrical shape communicating with said supply, and means for applying liquid coating material from said supply onto said peripheral surface of said pick-up roller; and,

means for mounting said coating apparatus to the press adjacent the delivery cylinder, said means including selectively operable means for moving said coating apparatus between a first operable position with a portion of said peripheral surface of said pick-up roller engaged with said delivery cylinder, and a second inoperable position with said peripheral surface of said pick-up roller out of engagement with said delivery cylinder, whereby when said coating apparatus is in said first operable

position, liquid coating material from said supply metered onto said peripheral surface of said pick-up roller is transferred to said delivery cylinder and to said freshly printed sheet, and when said coating apparatus is in said second inoperable position, said delivery cylinder is disposed for non-coating sheet delivery operation.

13. The improvement as set forth in claim 12 wherein the effective diameter of said delivery cylinder covered by said coating blanket is sufficient to apply pressure to sheets against said impression cylinder as said sheets are pulled from said impression cylinder by said gripper bars.

14. The improvement as set forth in claim 13 wherein said coating blanket has a rubber outer support surface.

15. The improvement as set forth in claim 14 wherein said coating apparatus is disposed downstream of said delivery drive shaft in the direction of travel of said sheets during transport by said delivery conveyor system.

16. A sheet-fed, offset rotary printing press including:

at least one printing station having a blanket cylinder and an impression cylinder disposed for printing wet ink onto sheets passing therebetween;

a delivery conveyor system for pulling freshly printed sheets from the impression cylinder and transporting the printed sheets toward a sheet delivery stacker, the delivery system including a delivery drive shaft;

a delivery cylinder mounted to said delivery drive shaft and having an outer peripheral support surface adapted to engage and support a sheet being transported by said delivery conveyor system;

a coating apparatus including a supply of liquid coating material, a rotatable pick-up roller having an outer peripheral surface of substantially cylindrical shape communicating with said supply, and means for applying liquid coating material from said supply onto said peripheral surface of said pick-up roller; and

means for mounting said coating apparatus to the press adjacent said delivery cylinder, said means including selectively operable means for moving said pick-up roller between a first operable position with a portion of said peripheral surface of said pick-up roller engaged with said delivery cylinder, and a second inoperable position with said peripheral surface of said pick-up roller out of engagement with said delivery cylinder, whereby when said pick-up roller is in said first operable position, liquid coating material from said supply applied to said peripheral surface of said pick-up roller is transferred to said delivery cylinder and then to said freshly printed sheet.

17. A sheet-fed, offset rotary printing press as set forth in claim 16 wherein said delivery cylinder includes a removable coating blanket disposed over said peripheral support surface when said pick-up roller is in said first operable position.

18. A sheet-fed, offset rotary printing press as set forth in claim 17 wherein said coating blanket has a rubber outer surface.

19. A sheet-fed, offset rotary printing press as set forth in claim 17 wherein said delivery cylinder includes a fabric net disposed over said peripheral support surface when said pick-up roller is in said second inoperable position.

20. A sheet-fed, offset rotary printing press as set forth in claim 19 wherein said coating apparatus includes an elongated reservoir containing said supply of liquid coating material, said reservoir being disposed to extend parallel with said pick-up roller with a portion of said peripheral surface extending into said reservoir in contact with liquid coating material contained therein, and at least one doctor blade attached to said reservoir and engaging said peripheral surface, said doctor blade acting to limit the amount of liquid coating material applied onto said peripheral surface from said reservoir.

21. A sheet-fed, offset rotary printing press as set forth in claim 20 wherein said selectively operable means includes an extensible cylinder coupled between said reservoir and said press and operable to move said reservoir and said pick-up roller laterally between said first and second positions.

22. A sheet-fed, offset rotary printing press as set forth in claim 21 wherein said pick-up roller is rotatably driven by a motor attached to said coating apparatus.

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United States Patent [19]

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[54] **RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER**

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[21] Appl. No.: **544,996**

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Related U.S. Application Data

[63] Continuation-in-part of PCT/US90/03338, filed Jun. 13, 1990, which is a continuation-in-part of Ser. No. 365,680, Jun. 13, 1989, Pat. No. 4,934,305.

[51] **Int. Cl.**[5] **B05C 1/08**; B05C 1/02

[52] **U.S. Cl.** **118/46**; 101/177; 101/178; 118/211; 118/224; 118/262; 427/407.1; 427/558

[58] **Field of Search** 101/177, 178, 147, 146; 118/46, 211, 262, 224, 249; 427/54.1, 407.1

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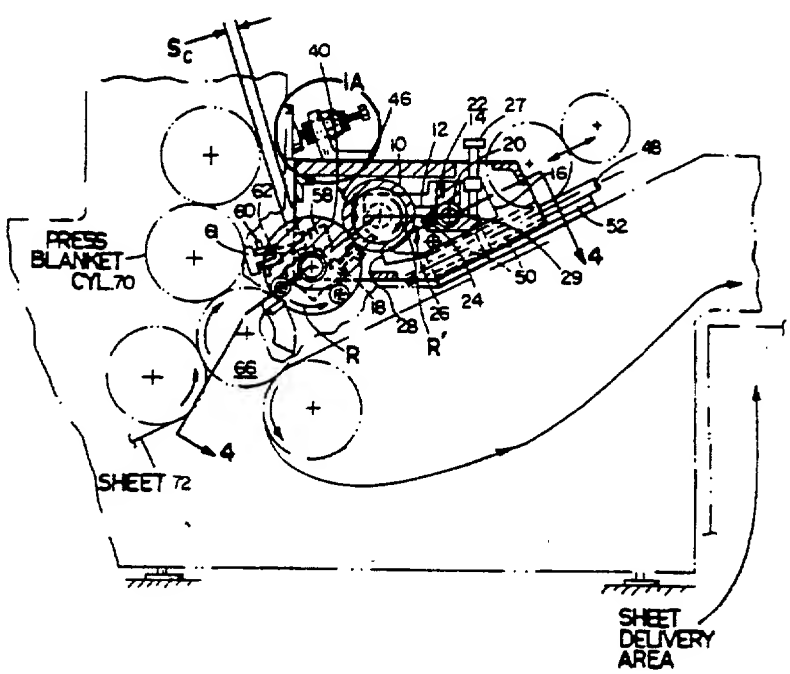
Primary Examiner—Willard Hoag

[57] **ABSTRACT**

An addition to a multi-color lithographic offset printing press comprising a self-contained coating unit moveable into and out of operative relationship with an impression cylinder on the press unit (e.g. the impression cylinder of the last press unit) without interrupting or disrupting printing taking place in this last stage. The coating unit includes a special blanket cylinder, a transfer cylinder and doctor or metering means to control the amount of coating material on the transfer cylinder. Inclined tracks are provided to guide the coating unit into and out of operative relationship with the impression cylinder of the last printing stage.

49 Claims, 10 Drawing Sheets



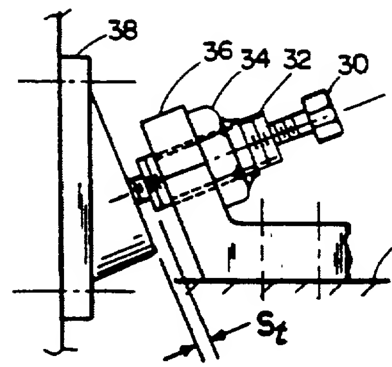

38
36
34
32
30
46
S_t

FIG. 1A

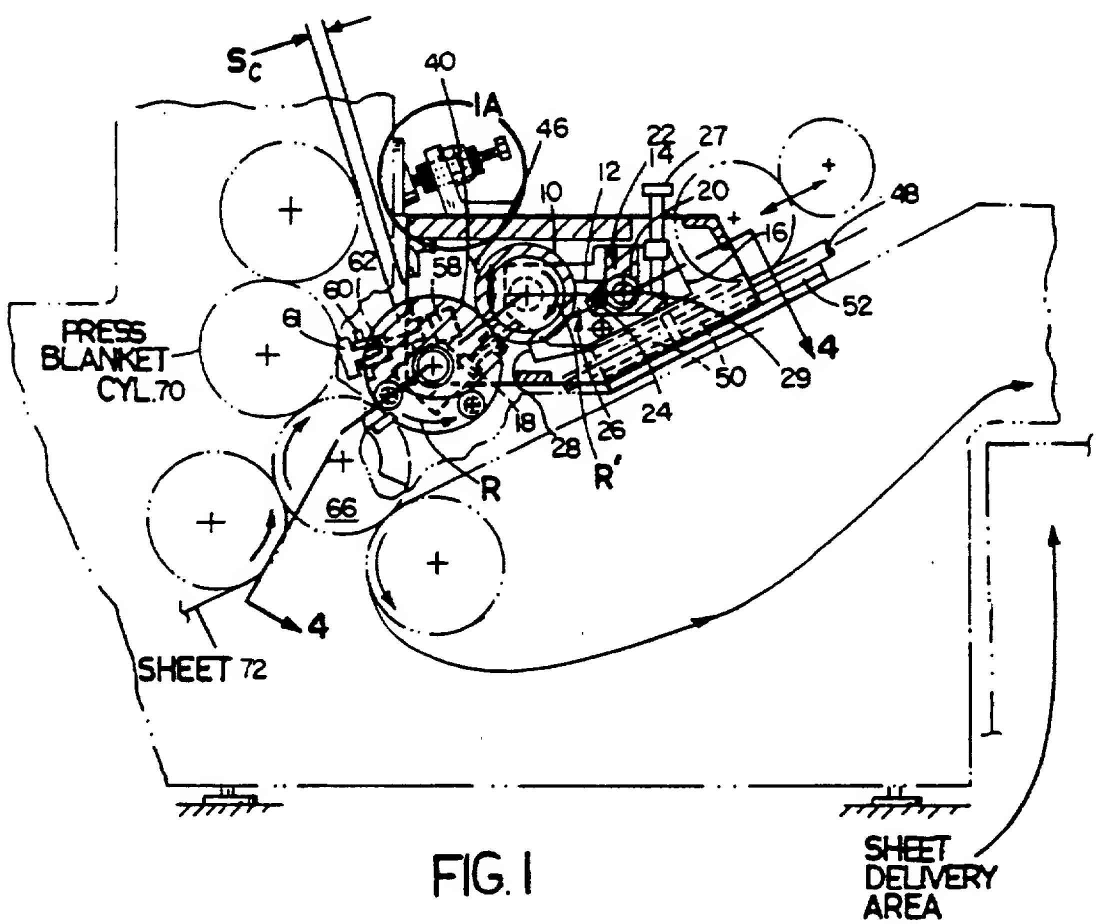

S_c
40
1A
46
22
27
14
12
20
10
16
48
62
58
60
61
PRESS BLANKET CYL. 70
52
4
50
29
24
26
18
28
R'
R
66
4
SHEET 72
SHEET DELIVERY AREA

FIG. 1

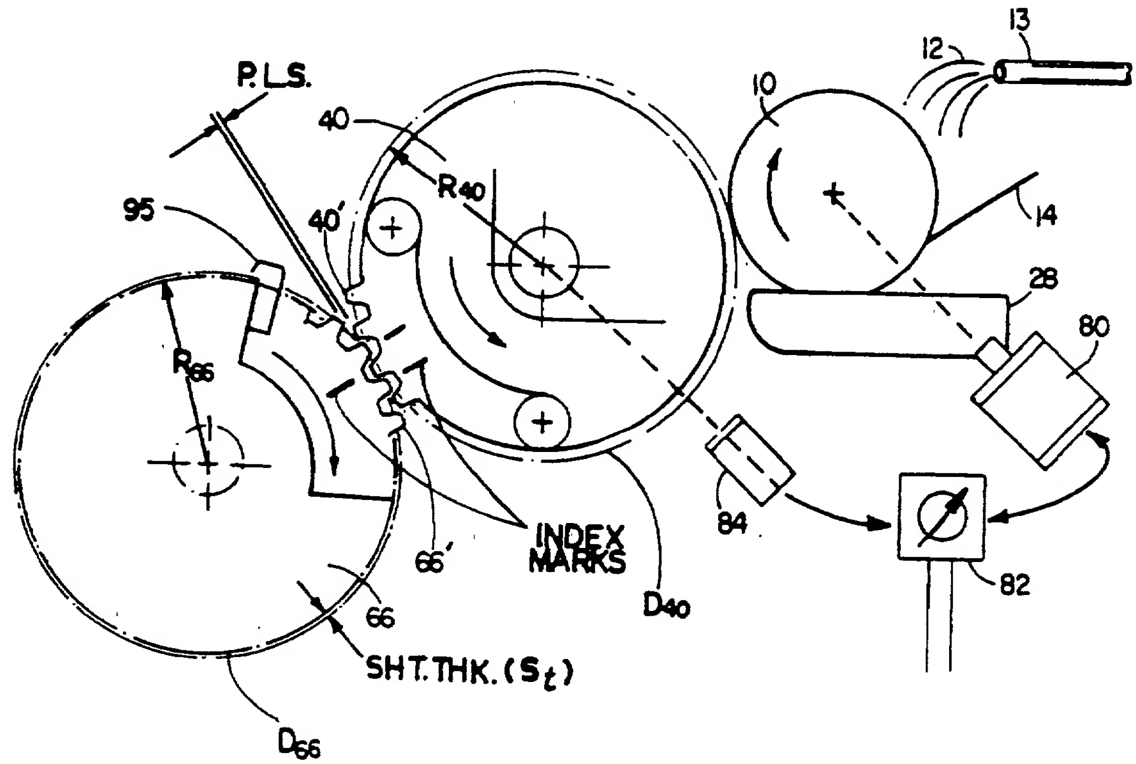

P.L.S.
40
R_{40}
95
40'
R_{66}
INDEX MARKS
66'
66
SHT.THK.(S_t)
D_{66}
D_{40}
84
82
80
28
14
10
12
13

FIG. 2

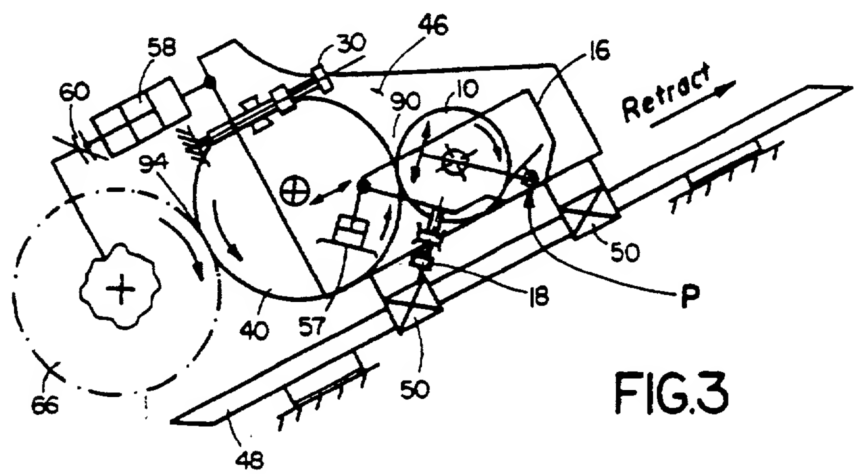

58
30
46
16
60
Retract
90
10
94
50
P
18
40
57
66
50
48

FIG. 3

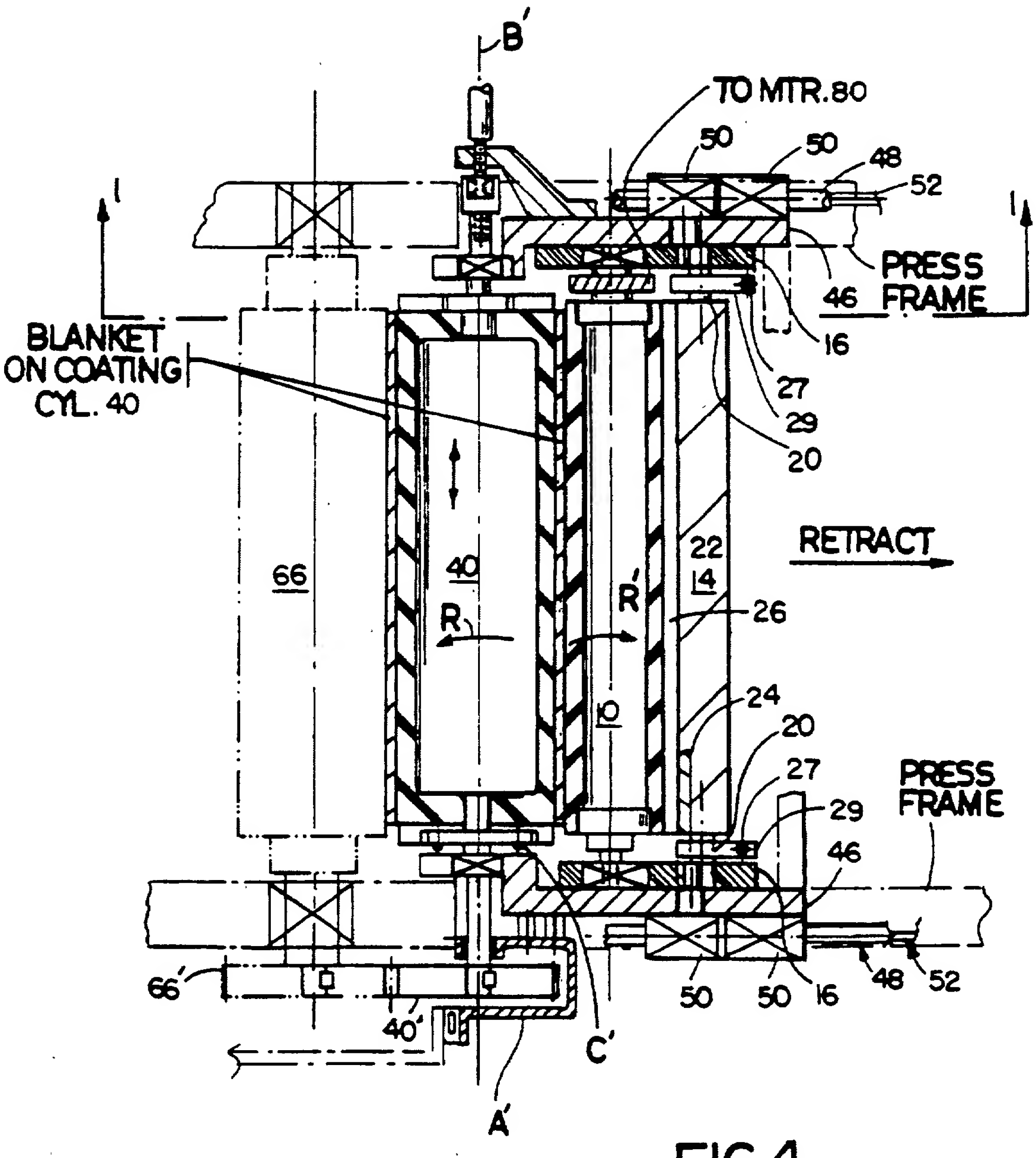
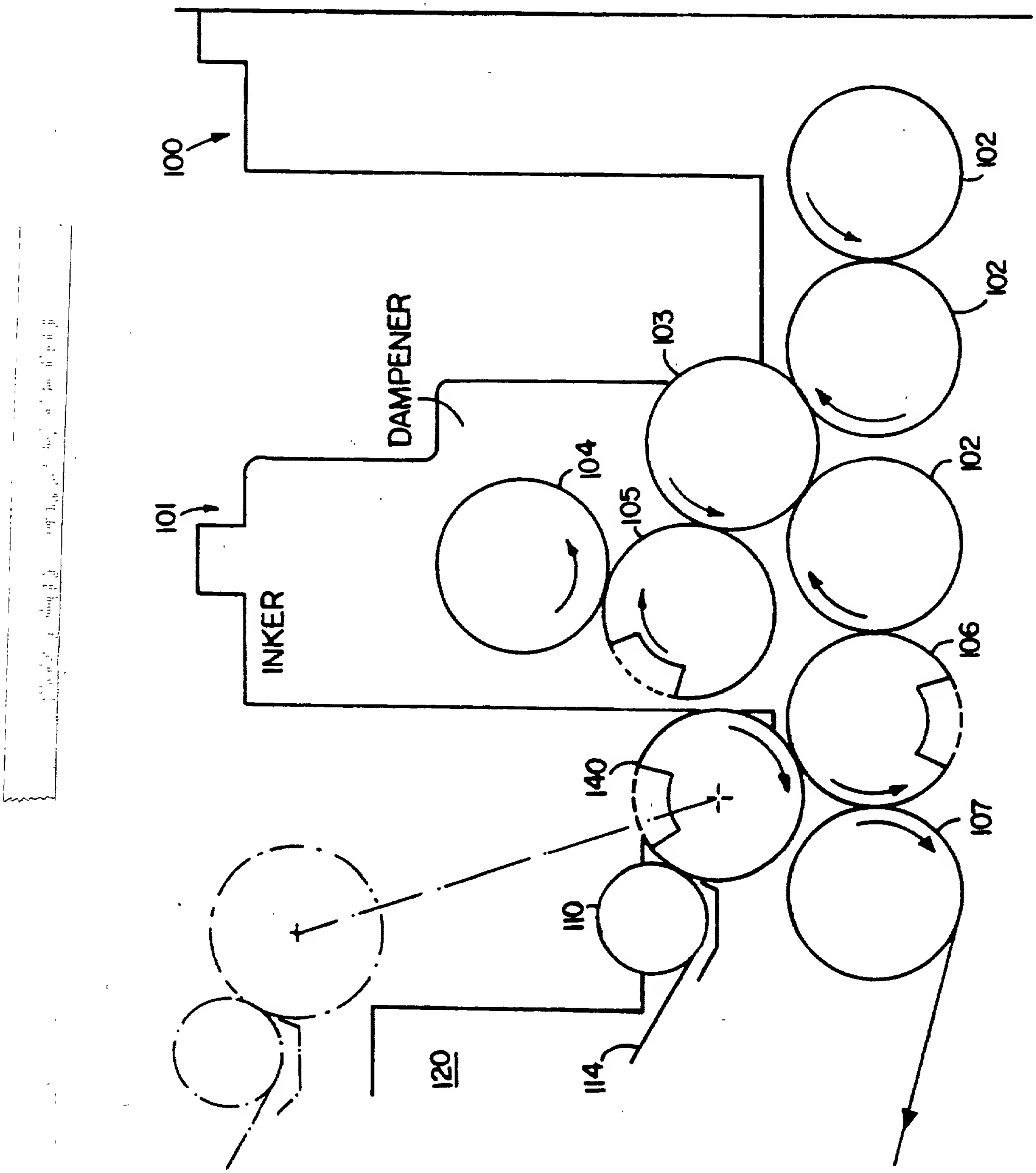

B'
TO MTR.80
50
50
48
52
I
I
PRESS FRAME
46
16
27
29
20
BLANKET ON COATING CYL. 40
66
40
R
R'
10
22
14
26
24
RETRACT
20
27
29
PRESS FRAME
46
66'
40'
C'
A'
50
50
16
48
52

FIG.4

FIG.5


100
101
DAMPENER
INKER
102
102
102
103
104
105
106
107
110
114
120
140

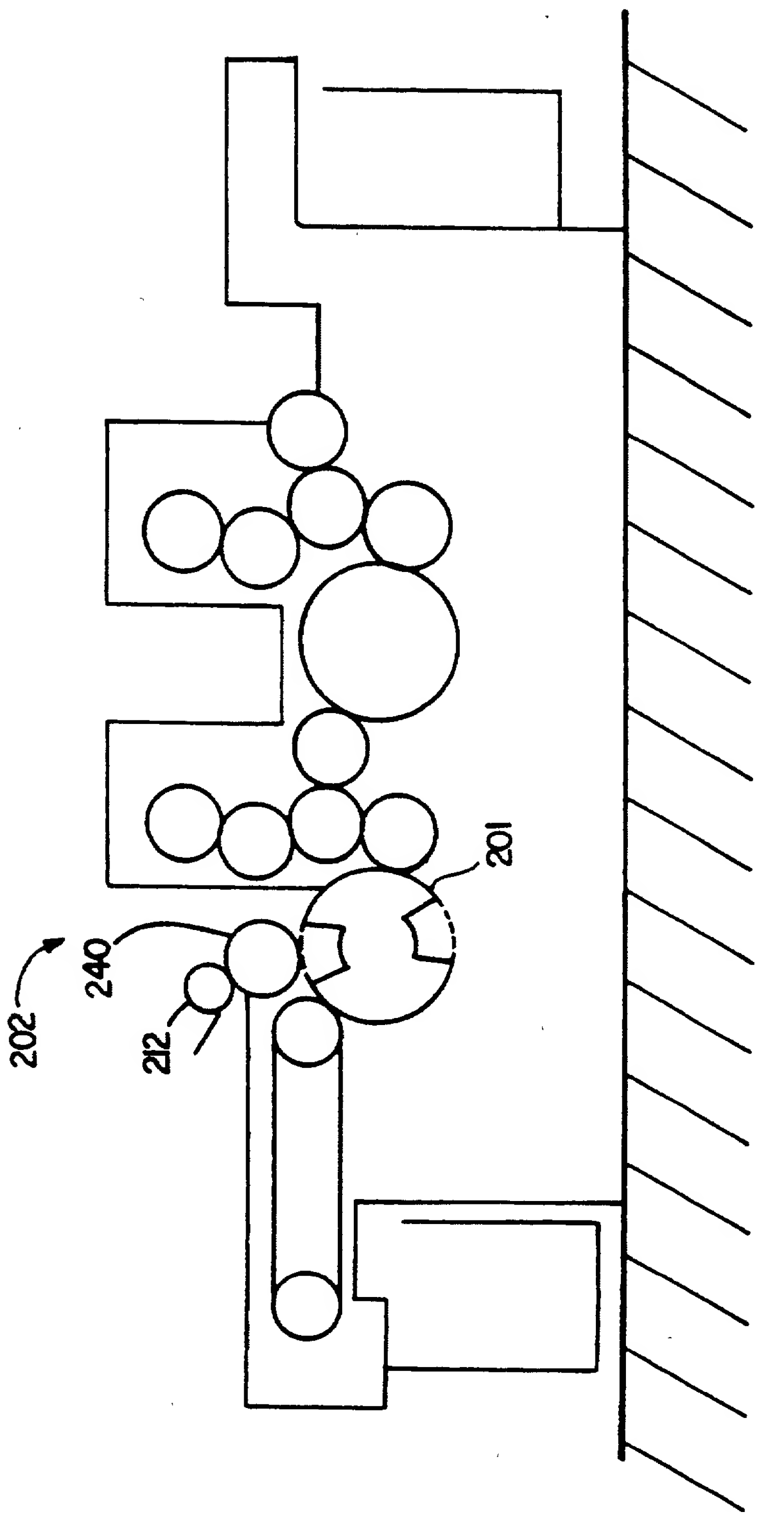


FIG.6

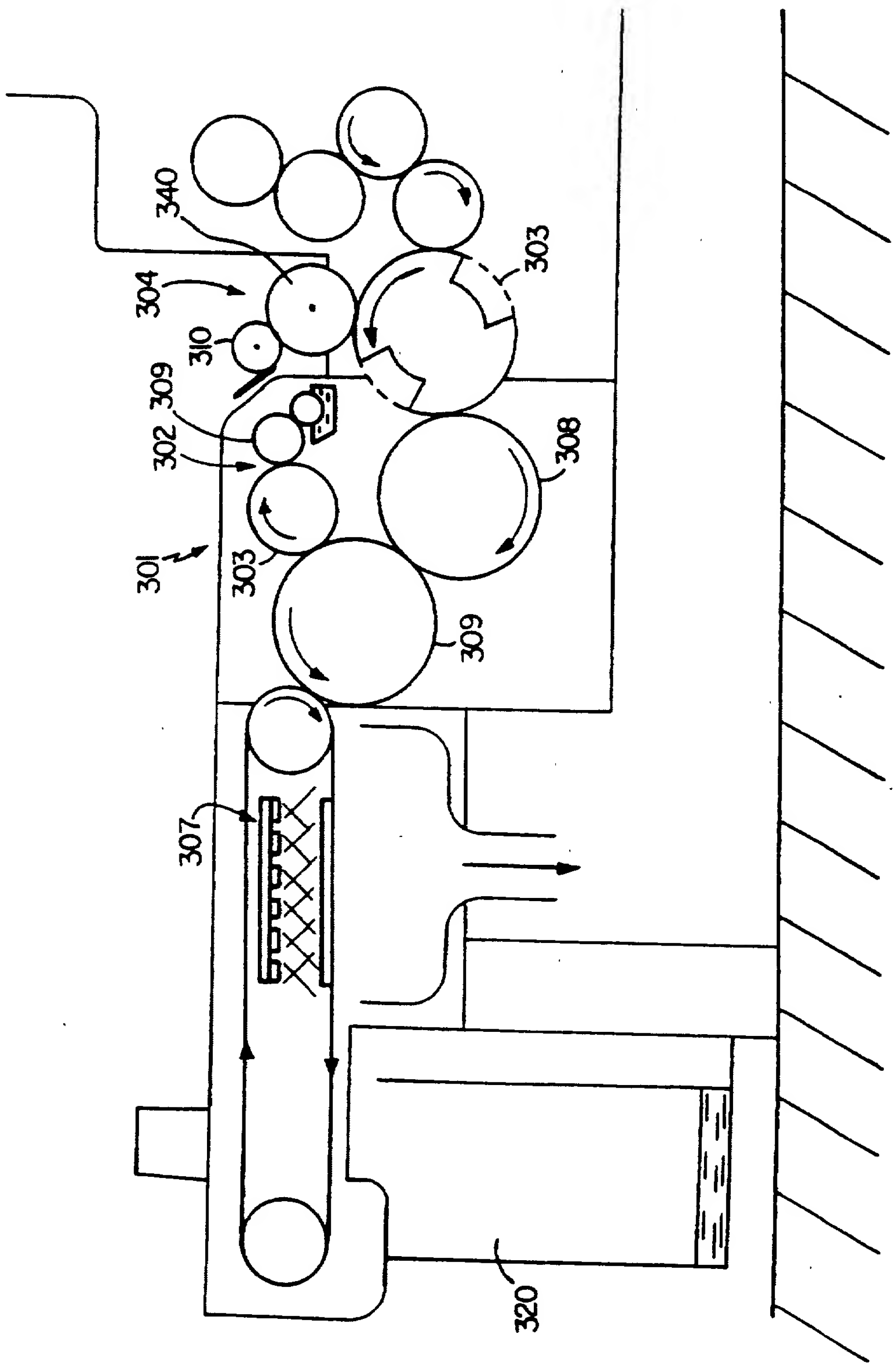


FIG. 7

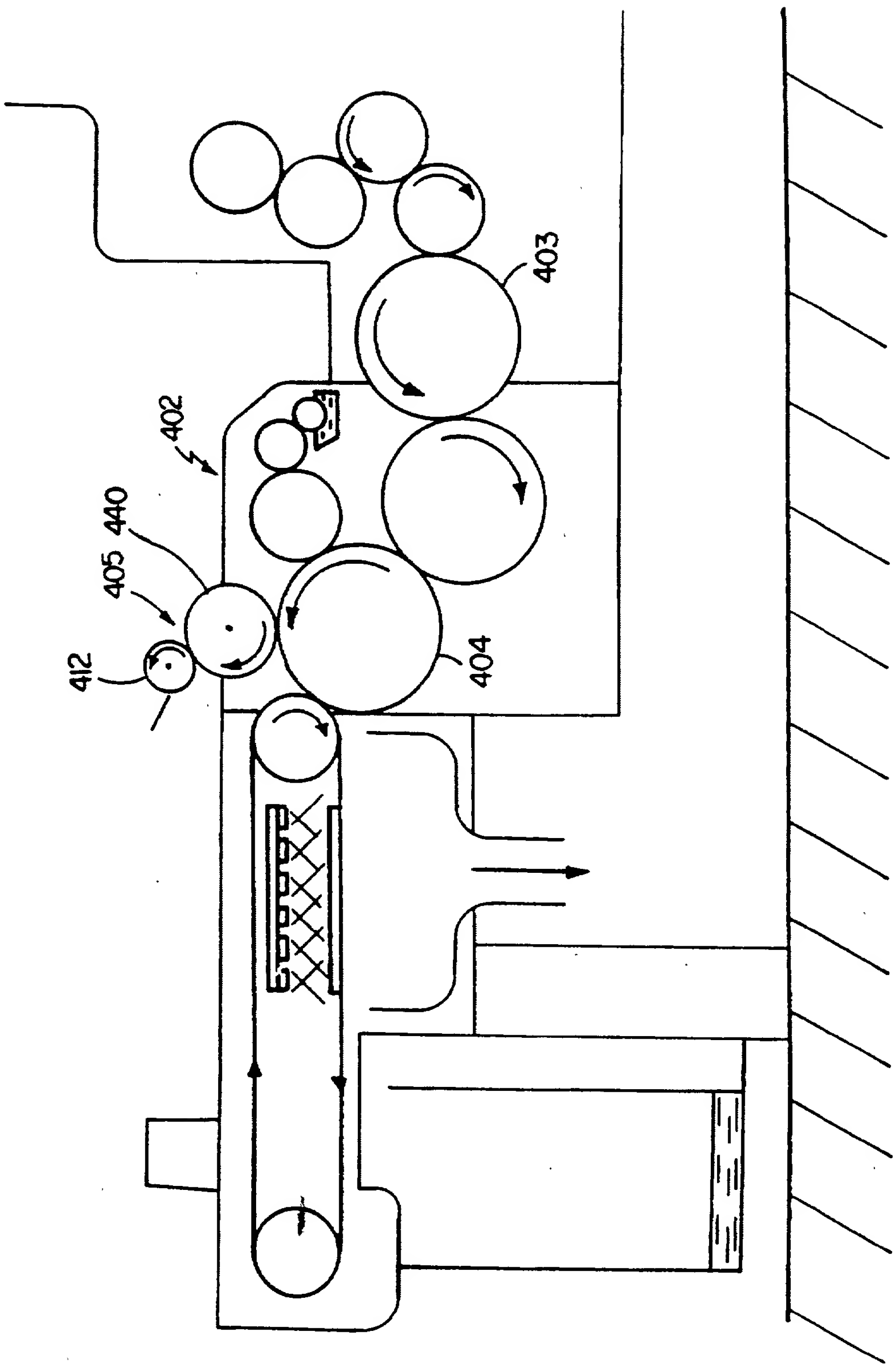


FIG.8

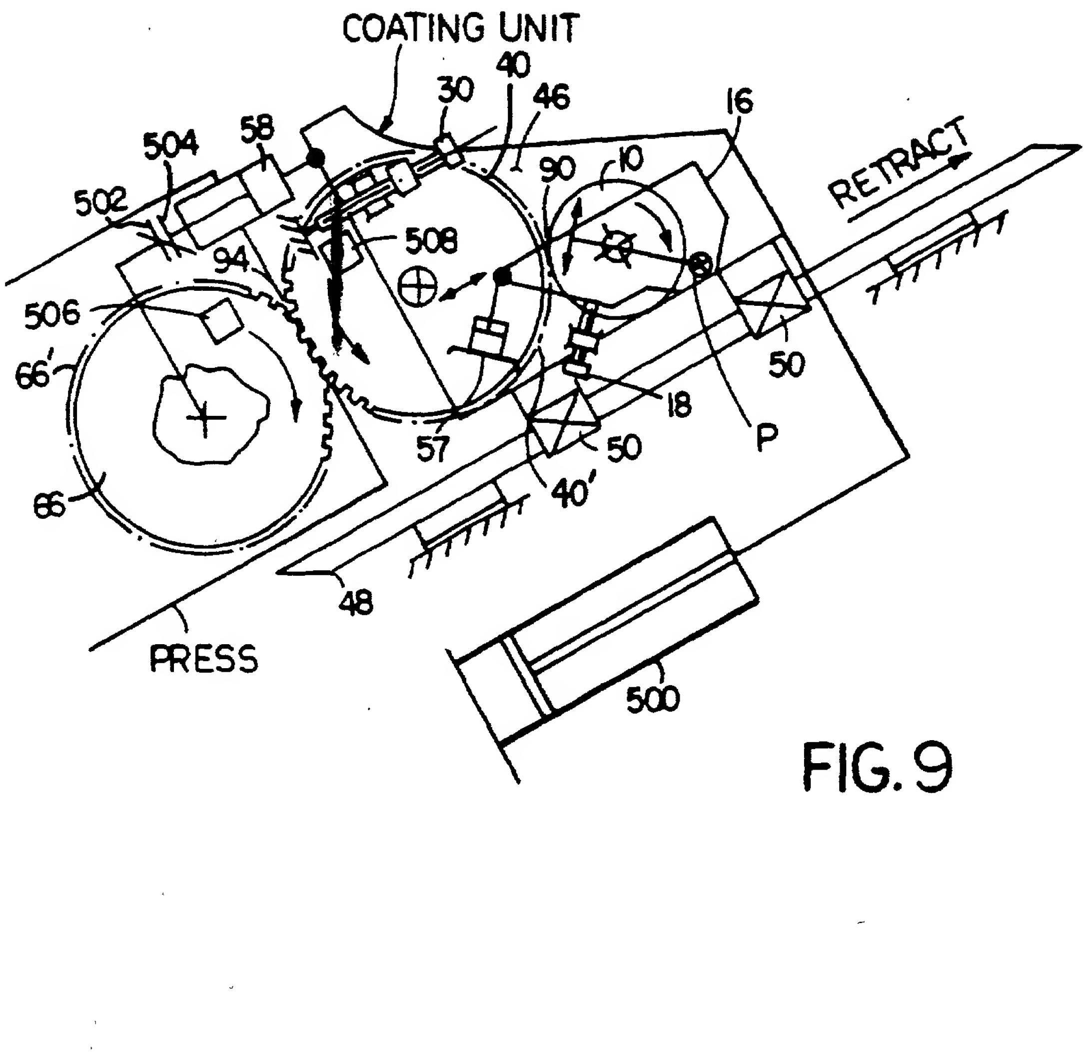

COATING UNIT
40
30
46
16
504
58
90
10
RETRACT
502
508
94
506
66'
50
18
P
57
50
40'
66
48
PRESS
500

FIG. 9

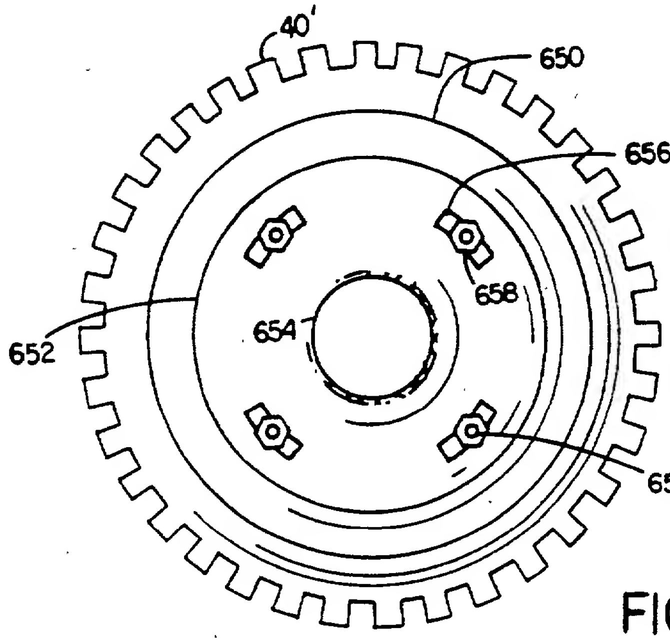

40'
650
656
658
652
654
658'

FIG. 10

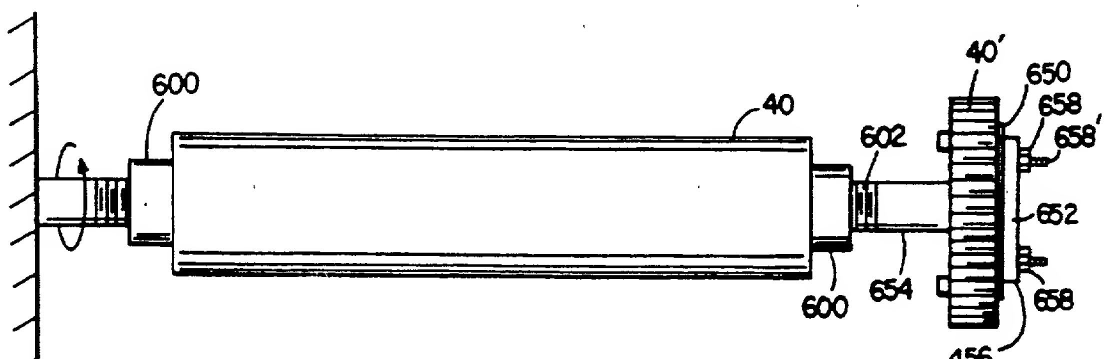

600
40
602
40'
650
658
658'
652
654
600
658
456

FIG. 11

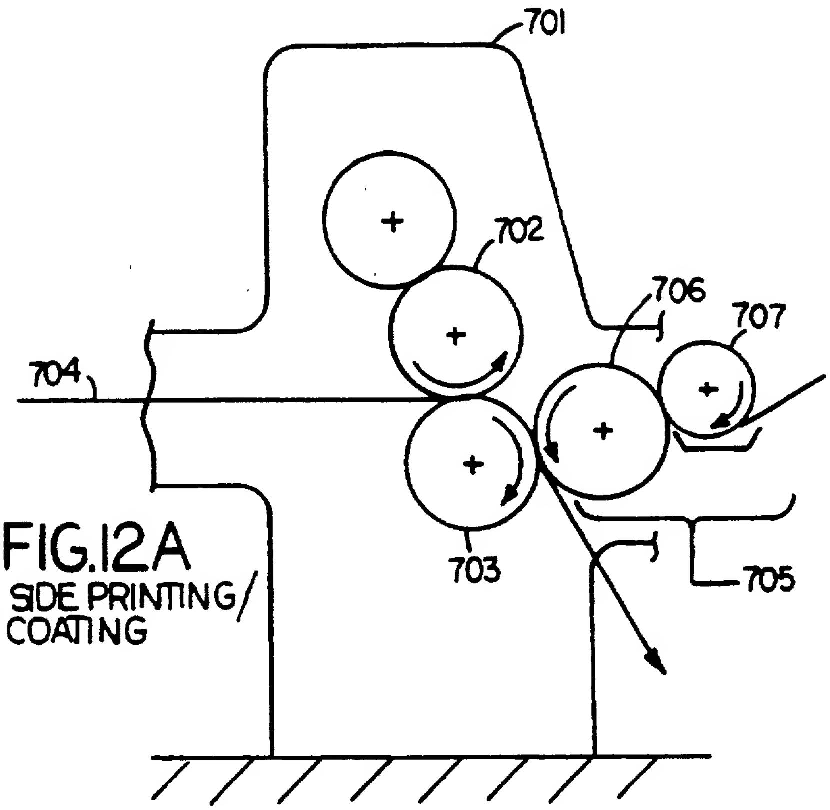


FIG.12A
ONE SIDE PRINTING/
TOP COATING

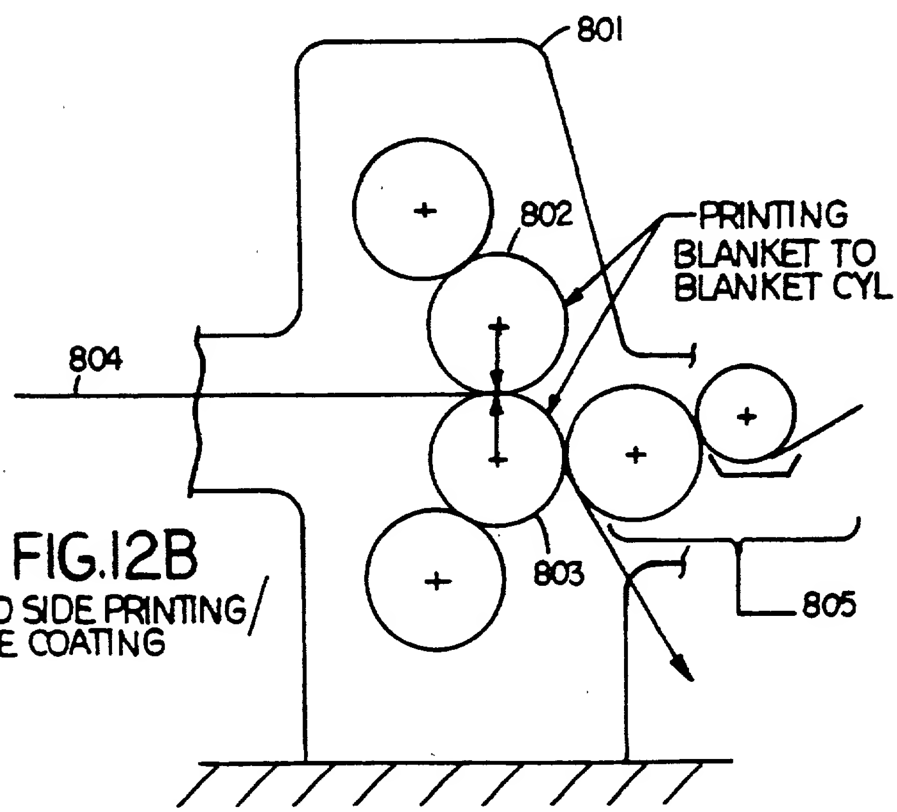


FIG.12B
TWO SIDE PRINTING/
SIDE COATING

RETRACTABLE COATER ASSEMBLY INCLUDING A COATING BLANKET CYLINDER

BACKGROUND OF THE INVENTION

This application is a continuation-in-part of PCT/US 90/03338 filed Jun. 13, 1990, which in turn was a continuation-in-part of U.S. Ser. No. 365.680, filed Jun. 13, 1989 and now U.S. Pat. No. 4,934,305.

This invention relates to coating printed workpieces, e.g. sheets. It more particularly refers to a process and apparatus for coating workpieces which have been printed on offset printing equipment.

In many applications it is desirable to apply a spot or overall coating to a printed workpiece. For example, a UV curable or water-soluble polymer finish may be applied to a workpiece printed by offset lithography. The coating is quickly dried while the surface of the ink is still tacky. This coating avoids the need for powder driers sprayed between sheets to present offsetting of oxidation-dried inks that are slow to dry. These coatings are also useful for providing a glossy finish that improves the rub-resistance of the workpiece and improves its overall appearance and feel. Finally, adhesive coatings may be applied to printed packaging; for example, heat-set adhesives may be applied to enable attachment of a feature such as clear plastic bubble of a package used to display the product. It is said that ultraviolet-cured and aqueous overprint coatings are, by some measurements, the fastest growing segments of the printing industry.

Application of coatings to a workpiece is made difficult by various requirements. For example. the coating should be uniform and its thickness should be controlled. Moreover, the aqueous coating should be applied quickly, before its vehicle evaporates causing it to thicken. Finally, it is desirable for the coater to operate "in-line" with the press that prints the workpiece to take full advantage of the fast-drying capability of coatings and generally to simplify the manufacture of printed coated workpieces.

Butler U.S. Pat. No. 4,270,483 discloses an in-line coating apparatus for attachment to a conventional offset lithographic printing press. The apparatus includes a set of rollers (i.e., pick-up roller **14** and application roller **16**) to deliver coating material from a reservoir **18** to a standard press unit blanket roll **108**. A metering rod **40** meters the amount of coating transferred to application roller **16**.

An in-line coater sold by Norton Burdett Co. of Nashua, N.H. has a single roller driven directly by a D.C. motor. The roller is a gravure cylinder that transfers coating to a standard press unit blanket cylinder. The coater is attached to a pivoting arm, and the unit can be pivoted away from the press unit when the coater is not in use.

Another in-line coater, sold by IVT Colordry, Inc. of Fairfield, Conn., applies coating from a reservoir pan to a standard press unit blanket cylinder using a pick-up roller that delivers a coating supply to an applicator roller; the applicator roller applies the coating to the blanket cylinder of a press unit.

Kumpf U.S. Pat. No. 3,768,438 discloses a coater in which a fountain roller dips into a coating reservoir and transfers liquid coating material to a feed roller. The feed roller in turn transfers coating material to a coating roller that coats a sheet fed between the coating roller and a format roller.

DiRico U.S. Pat. No. 4,685,414 discloses a process and apparatus for use in combination with an existing press unit wherein the coating means is retractable, to be used or not as the printer requires. In this device, the coating means utilizes the blanket roll of the last unit of the press, and this last unit cannot be used for color application means when it is used for coating. For example in a four color press, utilizing the coating apparatus of the '414 patent would then permit only three colors to be printed in in-line, single pass operation.

Bird U.S. Pat. No. 4,796,556 discloses an offset lithographic apparatus with a plate cylinder and a blanket cylinder, and an in-line coater to apply liquid coatings either in a pattern or over the entire workpiece. The apparatus has a carriage which moves the coater between a first position operative association with the plate cylinder of the lithographic press unit (see full line of unit **72** in FIG. **1**) and a second position in operative association with the blanket cylinder of the lithographic press unit (see broken line of unit **72** in FIG. **1**). In the first position the coater applies spot coating, and in the second position the coater applies coating over the entire sheet.

Satterwhite U.S. Pat. No. 4,308,796 discloses apparatus for adapting an offset lithographic press to flexographic operations, the flexographic operation being either for coating or printing. Coating is achieved by applying a photosensitive plate to the lithographic blanket roll of the offset press. A transfer roll supplies coating to the plate. Inking is achieved in a like manner but with a flexographic plate having raised image areas.

Makosch U.S. Pat. No. 4,397,237 discloses a pivoting secondary inking system ("B" in FIG. 2).

Preuss et al. U.S. Pat. No. 3,391.791 discloses a sheet coater which moves into engagement with various cylinders in a press delivery area.

Knodel et al. U.S. Pat. No. 3,916,824 discloses a coating assembly which includes a fountain roll. a metering roll and an applicator roll for coating band of ribbon material. The coater is horizontally displaceable on an auxiliary frame.

Jahn U.S. Pat. No. 4,615,293 and 4,706,601 disclose separate duplex coating units disposed downstream of a printing press. The units permit coating of selected portions of the workpiece using a relief plate or permit blanket coating.

Switall U.S. Pat. No. 4,617,865 discloses a coater that can be pivoted into and out of position in contact with the blanket cylinder of the press unit; the coater being retractable with the same limits as that of the Di Rico device, i.e., the coating and printing functions cannot be performed simultaneously.

Jirousek U.S. Pat. No. 2,320,523 discloses a self-adjusting dampening roll.

Edwards U.S. Pat. No. 4,222,325 discloses a retractable dampening and inking unit.

Egnaczak U.S. Pat. No. 3,800,743 discloses a coater for a photoelectrophoretic process.

DeLigt U.S. Pat. No. 3,397,675 discloses a coating or printing station having its applicator and transfer rolls attached to pivotally mounted supporting frames.

Some commercial presses, such as Heidelberg GTO and MO include an extra blanket cylinder e.g.. for numbering, printing extra colors, perforating, center slitting. etc. This added cylinder is a fixed part of the press, and

does not retract with associated equipment for numbering or imprinting.

SUMMARY OF THE INVENTION

This invention generally features a coating apparatus that operates on line with an impression cylinder of a lithographic printing press to apply a liquid coating to a workpiece. The invention is particularly (but not exclusively) adapted to sheet-fed lithographic presses. The coating apparatus of the invention has an integrated, independent, cooperatively operating, coating assembly whose components include a liquid coating supply means, a special coating blanket cylinder (in addition to any blanket cylinder(s) that are already part of the press), and means for metering and transferring coating material operatively connected to the coating blanket cylinder and to the liquid coating supply means, for controlling the amount of coating supplied onto the coating blanket cylinder from the supply means. Structural members integrate the means for metering and transferring coating and the coating blanket cylinder into the coating assembly so that the coating assembly components remain fixed relative to one another as the assembly moves relative to the impression cylinder of the press. The apparatus also includes a means for positively driving the coating blanket cylinder in association with the press unit impression cylinder and mounts for guiding movement of the coating assembly between an operative position, in which the coating blanket cylinder is operatively engaged with the press unit impression cylinder, and an off-imprint (or off-impression) position, in which the coating blanket cylinder and drive is slightly separated from the impression cylinder (i.e., separated sufficiently to prevent contact). In the operative position the coating blanket cylinder can be accurately adjusted relative to the impression cylinder. Moreover, the coating assembly can be actuated so the coating blanket cylinder is slightly separated from the impression cylinder. Such adjustment and actuation are achieved without a change in the coating blanket cylinder position relative to the coating metering and transfer means.

One embodiment of the system is especially adaptable to press types such as the Heidelberg Speedmaster TM line of presses, where there is access between the press blanket cylinder of the last press unit and the sheet transfer cylinder of the delivery to add a blanket cylinder for coating on the impression cylinder of the press unit. In this embodiment, the press impression cylinder which engages the coating assembly is also operatively associated with the printing blanket cylinder on the press. In operation, a sheet on the impression cylinder contacts the printing blanket at a first location on the sheet while it contacts the coating assembly blanket at a second location on the sheet, enabling simultaneous printing and coating at a single impression cylinder.

Alternatively, in other embodiments for presses that cannot accommodate the coating assembly at the press impression cylinder, it is possible to replace (retrofit) a press transfer cylinder with an impression cylinder that can accommodate the coating blanket cylinder of the coating assembly. For example, where the printing press comprises an accessible transfer cylinder, an impression cylinder may be retrofit into a position ordinarily occupied by the transfer cylinder. One version of this embodiment features using the coating assembly at an impression cylinder that has been retrofit in place of a transfer cylinder upstream from a tower coater. In this embodiment, the sheet workpiece is precoated prior to coating at the tower coater.

Yet another preferred embodiment of the invention features retrofitting a fixed coating tower with the coating assembly of the invention. The fixed coater has an impression cylinder operatively connected to a fixed coating blanket cylinder. The coating assembly is retrofit to the fixed coating impression cylinder so that the coating assembly blanket cylinder of the invention and the fixed coating blanket cylinder both operate simultaneously on the fixed coating impression cylinder. In this way, two layers of coating are applied simultaneously to the same workpiece.

The coating blanket cylinder of the coating assembly is adapted to provide a coating surface, which preferably is the generally same basic diameter as the standard printing blanket cylinder. By "adapted to provide a coating surface", we mean that the coating blanket cylinder can receive a standard resilient blanket, or it can receive a relatively hard or resilient relief plate or its equivalent. Alternatively, the cylinder could have a surface with permanent relief. For spot-coating, the coating blanket cylinder carries a photopolymer relief plate or equivalent. This cylinder is also preferably equipped for circumferential and lateral (side) register to enable accurate positioning of the plate. Pin register may also be supplied for pre-positioning of the plate relative to the positions of upstream printing plates. Pin-register may be supplied in lieu of, or, in conjunction with circumferential and side register means. The photopolymer plate may be installed in the same blanket reels or clamps as provided for the blanket, or, may be attached to the cylinder, independent of the blanket clamping provisions. The coating blanket cylinder continuously delivers a smooth, uniform metered amount of liquid coating material to the workpiece carried on the press unit impression cylinder.

Preferred embodiments of the invention are characterized as follows. The mounts guide the coating assembly to move to a fully retracted position in which the assembly and particularly the coating blanket cylinder are completely disengaged from the press unit impression cylinder at a remote location from the press unit cylinders. The coating transfer means comprises a transfer (delivery) cylinder (e.g. an engraved or smooth cylinder) in operative contact with the coating blanket cylinder, as well as a metering means (an elongated blade or a metering roll) for metering the amount of coating carried on the transfer cylinder. The coating assembly is mounted on an inclined support attached to the press frames of the delivery section of the press. Means are provided for moving the coating apparatus toward or away from the press unit. Specifically, these means can include a hydraulic cylinder. Coating is circulated by recirculation means. Coating is supplied between the transfer means and the metering means, flows longitudinally along the length of the transfer and metering means and cascades at the ends thereof to a drip pan positioned below the metering means. A drip pan outlet is in operative association with the recirculation means, and the coating supply means communicates with the recirculation means, to supply recirculated coating to the transfer and metering means. The coating blanket mounted on the blanket cylinder and the press unit blanket cylinder have substantially the same effective operating diameter. The apparatus includes means to control pressure or width of the nip between the transfer cylinder and the coating blanket

cylinder. The apparatus also includes means to control the actuation, adjustment and speed of the transfer cylinder relative to the blanket cylinder. A gear is adapted to positively, drivingly, couple the coating blanket cylinder to the impression cylinder when the assembly is in the first (operating) position. This gear can be made of a special plastic material. Additionally, the impression cylinder includes a gear adapted to drive the gear on the coating blanket cylinder. Means are provided for registering the coating blanket cylinder gear with the adjacent impression cylinder gear. Proximity sensors located on the coating blanket cylinder gear and the impression cylinder gear are utilized to rotationally align these gears with one another. The press will not start unless the gears are sensed to be in the proper position relative to each other. The apparatus also includes means for adjusting the coating blanket cylinder relative to the press unit impression cylinder while the two cylinders remain drivingly engaged. An adjustable stop controls the nip between the coating blanket cylinder and the impression cylinder, without changing the relationship between the coating blanket cylinder and the liquid coating metering and transfer means. Specifically, this stop can be a threaded screw. The coating blanket cylinder is preferably lightweight (aluminum) with means enabling lateral and/or circumferential register adjustment relative to the adjacent press impression cylinder. Circumferential register adjustment means includes a plurality of bolts and nuts, as well as correspondingly positioned slots in a plate secured to the coating blanket cylinder, which are adapted to allow for rotational movement of the coating blanket cylinder with respect to the coating blanket cylinder gear. Lateral register adjustment means includes threaded collars adapted to allow for lateral movement of the coating blanket cylinder, located at both ends of said coating blanket cylinder. There is provided a means of locking the coating apparatus to the press unit. Specifically, the means can include a cylinder clevis and a press-mounted lug, cooperatively sized and positioned to engage said clevis, and a releasable latch pin adapted to connect the clevis to the lug. Alternatively, the means can include a pair of cooperatively sized and positioned electromagnets which, when de-energized, allow the coating assembly to be released for movement to a location remote from the press unit.

This invention thus provides a direct coating system for a sheet fed printing press, preferably a multi-color press, and enables in-line printing and coating at the same time on a single press unit, thus maintaining the printing capability of the printing press unit. When a press unit (preferably the final press unit) is retrofitted with the retractable coating assembly of this invention, an existing impression cylinder in the press unit may act as a common impression cylinder, so that ink is first applied to a sheet being fed on the impression cylinder and a coating is applied directly to the sheet over the last ink application. After this dual sequential application of ink and coating onto a sheet on the same impression cylinder, the coating can be suitably dried by air, infra-red heat, ultra-violet radiation or any other means adapted to quickly dry the coating.

This apparatus is capable of delivering a metered amount of coating through a special blanket roll to a sheet carried by the last impression cylinder in a printing press substantially without interrupting or changing the printing process. It allows spot coating or overall coating as may be desired by the printer. It operates without the use of bulky complex metering systems, yet the apparatus is versatile in that the printer can bring the coater in line or not, as he desires, without changing or interfering with an existing printing operation. Adjustment of the coating blanket cylinder and entire assembly is made relative to the impression cylinder to compensate for various sheet thicknesses to be printed. The assembly is furthermore actuatable while still drivingly engageable with the impression cylinder, to on-off positioning of the cylinder when operating in the first position.

The entire apparatus is further retractable to the second position by a simple retraction device, such as a linear-actuator, winch, hydraulic cylinder or the like, up an inclined plane (the same plane as for movement for adjustment and actuation), to provide access to: (1) the coating blanket cylinder for changing blankets, packing, clean-up, maintenance, etc.; (2) the standard printing blanket cylinder; (3) the impression cylinder; and (4) the sheet delivery area, beneath the coating apparatus, housing the conventional Infra-red or UV drying unit. In this second retractable position, the apparatus may be used as a seat by the operator, as desired, for standard printing press unit operation.

A gear cover is provided about the blanket cylinder gear and is designed to resiliently sealingly engage the gear cover of the printing unit to which the coating apparatus is installed. When the coating unit is retracted, a cover is supplied to seal the cutout in the press gear cover. Therefore the integrity of the oil bath is maintained within the press gear cover in both operating and retracted positions of the apparatus.

A specific sequence of actuation of the transfer roll relative to the coating blanket cylinder, and actuation of the coating blanket cylinder (and, therefore, of the entire assembly) relative to the impression cylinder for proper coating operation, is specifically discussed later herein. This apparatus is well adapted to be built into a new printing press or to be retrofitted into existing equipment.

Other feathers and advantages of the invention will be apparent from the following description of the preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of the coating apparatus including a diagrammatic view of a printing press with which it is operatively associated. In this Figure the cylinders of the coating assembly are shown in solid in their coating operating position and in phantom in their retracted position. The coating apparatus is shown in section.

FIG. 1A is a side view of stop on the coating apparatus of FIG. 1.

FIG. 2 is a diagrammatic side view of a set of coating application rollers showing details of controls for positively, drivingly, linking these rollers to a printing system; and

FIG. 3 is similar to FIG. 2 showing a schematic view of controls for the coating apparatus hereof for adjustment, actuation and retraction of the coating assembly relative to the press, actuation and adjustment of the transfer roll relative to the coating blanket cylinder and the metering means relative to the transfer roll.

FIG. 4 is a cross-sectional view taken along lines 4—4 from FIG. 1.

FIGS. 5 and 6 are diagrammatic representations of two alternative embodiments of the invention, respectively, in which the coating assembly is engaged with an

impression cylinder retrofit in place of a transfer cylinder.

FIGS. 7 and 8 are diagrammatic representations of yet two additional embodiments of the invention, respectively, in which the blanket coater of the invention is employed with a coating tower on either an impression cylinder retrofit at a transfer cylinder of the last press unit, or directly on the impression cylinder of the coating tower.

FIG. 9 is diagrammatic illustration of the means of locking the blanket coating cylinder to the press impression cylinder.

FIG. 10 is a diagrammatic illustration of the means of circumferential register adjustment.

FIG. 11 is a diagrammatic illustration of the means of lateral register adjustment.

FIGS. 12*a* and 12*b* respectively show the coating assembly adapted to single-sided, and to two-sided, web printing applications.

SPECIFIC EMBODIMENTS OF THE INVENTION

This invention will be described with reference to the drawing in which like parts have been given like reference characters.

Referring now to FIGS. 1 and 4, the coating apparatus assembly of this invention comprises a transfer roller 10, journalled for rotation, onto which is fed coating material 12, and a metering assembly 14 which is suitably adjustably mounted relative to the transfer roll to deliver a predetermined quantity of liquid coating, substantially evenly along the surface of the transfer roller 10. This metering assembly 14 includes a rotatably mounted journal 20 which is generally parallel to the axis of the coating transfer roller 10. Mounted substantially centrally about the journal 20 is a housing 22 from which a blade clamp 24 extends. A doctor blade 26 is positioned in the blade clamp 24 and is angularly positioned against the transfer roller 10. The doctor blade 26 is suitably made of blue spring steel, suitably about ten thousandths of an inch thick, and suitably extends out of the clamp 24 about one half inch. The angular position of the blade 26 may be about 40° to a tangent to the transfer roller surface. It has been found to be useful to force the doctor blade 26 against the transfer roller 10 with a pressure of about one half to one pound per linear inch. The transfer roll (with the metering device) is mounted at each end thereof in a common frame 16 which is in turn rotatably supported in a coater assembly housing 46. Frame 16 is pivotally rotated, or otherwise moved, by cylinder 57, not shown, to adjustably engage transfer roll 10 to a lightweight (e.g., aluminum) coating blanket cylinder 40 for proper coating application. Movement of frame 16 does not affect pressure between roller 10 and blade 26. Likewise, movement of housing 46 does not affect the pressure setting, or the relative positions, of transfer roll 10 and coating blanket cylinder 40. Adjustable stop 18 is provided to set a light "kiss" pressure between roller 10 and cylinder 40.

A drip pan 28 having an outlet is provided, and is positioned below the transfer roller 10 and the metering assembly 14. The pressure exerted by the doctor blade 26 against the transfer roller 10 can be adjusted by means of two adjustment screws 27 which extend to corresponding adjustment brackets 29 clamped on the axle 20. It is preferred that the adjustment screws are attached to the brackets off center with respect to the axis of the axle 20 so that the rotation of these adjustment screws will pivot the axle 20 whereby changing the pressure of the doctor blade 26 on the roller 10. A cover may be provided over the coating 12 and roller 10.

A coating blanket cylinder 40 is provided in operative, takeoff contact with the transfer roller 10. The blanket roller has its own journals rotatably mounted, suitably in needle bearings, and supportingly attached to the same housing 46 as supports the common frame 16 for the transfer roller and metering assembly. This housing 46 is slidably mounted on rails 48 which, in a preferred embodiment of this invention, are inclined so as to easily move the coating assembly into and out of the line as well as provide a guide for adjustment and actuation of the coating blanket cylinder (and entire unit) relative to the impression cylinder of the press.

Specifically, the housing 46 is mounted on bearing blocks 50 that are in turn slidably mounted on the two parallel rails 48. The rails 48 are mounted on rail supports 52 which are adapted to be directly connected to the press unit.

Hydraulic cylinders 58 each with an adjustable clevis 62 are mounted on opposite sides of the housing 46 to provide proper actuation and a "kiss" pressure contact between the coating blanket on the special blanket cylinder 40 and the sheet on press impression cylinder 66. Suitably a latch 60 is provided to insure positive positioning and lock-up of the entire coating assembly with relation to the printing unit, i.e., the coating blanket cylinder 40 with the impression roller 66.

Double adjusting screws 30 and 32 are supported by support 36 attached to housing 46. Screw 30 bears against stop block 38, attached to the press frame. Screw 32 is locked by nut 34. Rotation of screw 30 provides for paper pressure adjustment and thickness changes in sheet stock, while setting screw 32 provides a safety such that gears mounted on the coating blanket cylinder and press impression cylinder, cannot be meshed beyond a preset point while in the coating mode of operation. Once nut 34 is tightened, the nut is fixed (as if it were welded or pinned) for a specific screw 32 setting. Clearance "S_c" in FIG. 1 depends on the thickness of the sheet, S_t which is generally between 0.000 to 0.030 inches. As shown in FIG. 1, clevis 62 is adjusted such that a clearance exists within cylinder 58, between the piston and cylinder wall. The piston serves as an "OFF" stop for the coating assembly when the assembly is actuated. A separation will therefore exist between the blanket and sheet when in the "OFF" impression position. For a theoretical 0.000 sheet thickness, S_c should be set for 0.060 inches approximately.

A gear-motor 80, which may be hydraulic or electric, is suitably provided to drive the transfer roll 10. Suitable means is provided to retract the coating assembly into and out of operative relation with the impression roller 66, up and down the rails 48.

The coating assembly is shown in cooperative relationship with a conventional series of printing rollers. The coating blanket on blanket cylinder 40 is in light "kiss" contact with the sheet on impression cylinder 66, the sheet on the impression cylinder being also in contact with a printing blanket on blanket cylinder 70; impression cylinder 66 thereby serves as a dual impression cylinder, first for printing and next for coating. The sheet work piece is shown at 72.

The coater is first locked into operation on the press unit by lowering it along the rails 48 toward the press unit and engaging clevis 62 to lug 61 mounted on the

press through releasable latch pin **60**. In operation, gear-motor **80** mounted on housing **46** rotates the roller **10** as coating fluid is pumped under pressure from a fluid reservoir (not shown) to an inlet opening in the doctor blade assembly. From there, coating spreads over the surface of roller **10** and is distributed by the doctor blade **26**. A continuous flow of coating is maintained over the surface of the roller **10** and excess coating is recovered through drip pan **28**, with an outlet for recycling. In this way, sufficient flow is maintained to provide a flooded nip of coating between roller **10** and blade **26** and to provide uniformity of coating along the rollers' length. The amount of coating carried by the transfer roller **10** can be adjusted somewhat by turning screws **27** to adjust the pressure between doctor blade **26** (or a metering roller) and the transfer roller **10**, as described above. Hydraulic cylinders **58** serve to pull the entire unit against the press with a force that can be adjusted by adjusting the pressure in the cylinders **58**. Screw **30** adjusts "ON" pressure between the coating blanket on blanket cylinder **40** and a sheet carried on impression cylinder **66**. Cylinders **58** further serve to separate the coating blanket cylinder from the impression cylinder while gears mounted on the adjacent cylinders still remain in mesh. Separation or clearance "S_c" in FIG. 1 is about 0.060 to 0.030 inches to provide an "OFF" condition of the coater assembly to stop application of coating. As the blanket cylinder **40** rotates in direction R, coating is applied to the just printed sheet. Transfer roller **10** rotates as shown by direction R'.

A uniform amount of liquid coating is continuously transferred to the blanket roller **40** at the nip between the blanket roller **40** and the transfer roller **10**. The blanket roller **40** in turn delivers that coating to the workpiece as the workpiece travels through the nip between the blanket roller **40** and the impression roller **66**. Changing the speed of roller **10** results in a change of coat weight added to the sheet.

When the coater is not in use, latch pin **60** is released, and a suitable means moves the coating unit back along the rails **48** away from the printing rollers.

More specifically, when using an acrylic water-based coating, a suitable transfer roller may be a quadrangular cell cylinder, having about 140 lines/inch, each square inch of cells carry 15 cubic billion microns of coating. A suitably engraved roller is sold by Pararco Roller Co. of Dallas, Tex. (Exact roll cell nomenclature is: 140 Rotoflo/138 for an optimum roll surface structure.) An acrylic water-based coating having about 45% solids can be applied to achieve an optimum dry coat weight of ~0.4–0.6 pounds per 1000 square feet, using a roll surface speed of 1:1 with that of coating blanket roll **40**.

Referring now to FIG. 2, there is shown a portion of a coating apparatus assembly including transfer roller **10**, coating material **12** fed from a supply thereof **13** and metered onto the roller by means of a doctor blade assembly **14**, including a drip pan **28**. The transfer roller **10** is suitably driven by direct drive gear motor **80** whose speed is controlled by a controller **82** responding to sensor **84** which senses the speed of the coating blanket cylinder **40**. Controller **82** is adjusted to provide a preset surface speed ratio, 1:1 or less, between roller **10** and cylinder **40**, the slowest surface being that of roller **10**. Impression cylinder **66** includes a sheet gripper **95**. The coating blanket on blanket cylinder **40**, and associated drive gear **40'**, preferably have the same operative diameter as the impression cylinder **66** and press gear **66'**. Gear **40'** is directly driven by press gear **66'** of cylinder **66** so as to insure a positive synchronized drive relation there between. In FIG. 2, no worksheet is shown in this figure for clarity. Index marks are placed on adjacent gears to insure proper register of adjacent cylinders. The gear pitch line separation "P.L.S." is approximately equal to the sheet thickness "Sht.Thk.", S_t, shown on cylinder **66**. D_{40} is a broken line corresponding to the outer diameter of the blanket on cylinder **40**, and the pitch line of gear **40'** and D_{66} is a broken line corresponding to the outer diameter of impression cylinder **66** and the pitch line of gear **66'**. R_{40} is equal to R_{66} and thus D_{40} and D_{66} are equal.

Referring now to FIG. 3 which is similar to FIG. 2, there is shown the same three rollers, the transfer roller **10**, the coating blanket cylinder **40** and the dual, common, impression roller **66**. The transfer roller **10** and the coating blanket roll **40** are shown commonly mounted in assembly **46** via bearing blocks **50**, on inclined rails **48**. There is shown in this figure a first cylinder **57** with stop **18** which adjusts the pressure in the nip **90** between the transfer roller **10** and the coating blanket on blanket cylinder **40**. A second cylinder **58** and screw **30** are provided to control the spacing in the nip **94** between the coating blanket on the blanket cylinder **40** and the dual impression cylinder **66** to accommodate a particular sheet thickness. The last color printing blanket roll **70** is not shown for clarity. Frame **16** pivots at P in FIG. 3.

FIG. 4 is a sectional view taken along lines **4—4** of FIG. 1 showing relationship or roll lengths to each other, a cover A' about the coating blanket cylinder drive gear, lateral and circumferential register provisions for the coating blanket cylinder, B' and C' respectively and other component parts shown in FIG. 1.

As best shown in FIG. 4, housing **46** is offset to the inside of the press frame in the area of the bearings for coating cylinder **40**, and therefore clears the press frame in this area. The remainder of the housing may lie along the inclined surface of the frame; that is, directly above the frame. This offsetting of housing **46** prevents having to alter (cut away) a portion of the press frame adjacent the bearing.

For sequencing of rolls for proper coating operation, the following procedure is followed:

"ON"	1. Transfer roll actuates to coating blanket cylinder upon actuation of press blanket cylinder of last printing unit.
	2. Coating blanket cylinder actuates to sheet on press impression cylinder upon one full revolution of press.
"OFF"	1. Transfer roll separates from coating blanket cylinder upon actuation of blanket cylinder of preceding press unit.
	2 Coating blanket cylinder separates from the sheet on the press impression cylinder upon actuation of the press blanket cylinder of the last printing unit

An alternate embodiment is shown in FIG. 5, which is particularly applicable for press units which cannot accommodate a coating assembly according to the invention in operable association with the press unit blanket cylinder as described above. In FIG. 5, an impression cylinder is installed downstream of the final press unit, in place of a sheet transfer cylinder which ordinarily transfers the workpiece along a path from the final unit to the press delivery.

Specifically, press units **100** and **101** generally correspond to the Miehle Super 60" press. The positioning of certain cylinders in that press does not permit installation of a coating assembly as described in the embodiment of FIG. 1. Existing press unit **101** includes sheet transfer cylinders **102**, an impression cylinder **103**, and plate and blanket cylinders **104** and **105**. Ordinarily, the cylinders at positions **106** and **107** are also sheet workpiece transfer cylinders to transfer the workpiece from the final unit **101** to the delivery area **120**.

According to the invention, the sheet transfer cylinder ordinarily occupying position **106** is replaced by an impression cylinder which cooperates with a retractable coating assembly having a coating blanket cylinder **140** as described above. Other components of the coating assembly of FIG. **5** (e.g., transfer cylinder **110** and metering assembly **114**) are the same as described above and require no further description. The operation of the apparatus of FIG. **5** is analogous to the operation of the above-described apparatus of FIGS. **1-4**, and the coated sheet is transported to the press delivery.

FIG. **6** shows a similar arrangement for a small (25") Heidleberg MO ® press, in which a double-size sheet transfer cylinder at position **201** has been replaced with a double-size impression cylinder. A retractable coating assembly **202** according to the invention is positioned in operative association with the impression cylinder at **201**. Coating assembly **202** includes a coating blanket cylinder **240** and a coating transfer cylinder **210**.

FIG. **7** shows an arrangement featuring the use of a coater on a press that includes a Heidleberg coating tower **301** downstream from the final press unit. The coating tower includes a standard coating unit **302**, having an application cylinder **303** which applies coating to a workpiece nipped between application cylinder **303** and coating impression cylinder **309** for applying a coating. A retractable coating assembly **304** according to the invention can be added by replacing the transfer cylinder at position **303** with an impression cylinder, and adding the coating assembly **304** upstream from the standard unit **302**. Coating assembly **304** includes a retractable blanket cylinder **340** and a coating transfer cylinder **310**, each of which is substantially similar to the coating cylinders described in FIGS. **1-4**. The workpiece is transferred via transfer cylinder **308** to coater **301**. In this way, it is possible to apply a water-based pre-coat to the sheet workpiece at unit **304**, upstream from the application of a U.V. sensitive coating at standard unit **302**. The precoating is dried before the U.V. coating is cured at station **307**. After coating, the sheet is presented to the press delivery **320** in the standard way. Such a double coating system is particularly useful where the ink and the U.V. coating are not compatible, requiring the intermediate pre-coating layer to separate them.

FIG. **8** shows an alternative retrofit of the coating tower shown in FIG. 7. Specifically, the cylinder in position **403** is a standard transfer cylinder. Coating impression cylinder **404**, which is part of the standard coating unit **402** serves to apply a second layer of coating from the coating assembly **405** according to the invention, which is retrofit to work in cooperation with impression cylinder **404**. Coating assembly **405** includes a blanket cylinder **440** and a transfer cylinder **410** as described above. The remainder of the coating tower and delivery is generally as described for FIG. 7, and further description is not necessary here. The embodiment of FIG. **8** is useful for applying a double layer of coating at a single impression cylinder, with the first layer being applied by the standard coating unit **402** and the second layer being applied as described above.

Another alternate embodiment is shown in FIGS. **9-11** which includes alternative features of the coating unit embodiment illustrated in FIGS. **1-4**.

A different method of "locking" the coating unit (e.g. the unit of FIG. 3) to the press is illustrated in FIG. **9**. The coating unit is displaced down the rails **48** by means of a hydraulic cylinder **500**. Once in the vicinity of the press, electromagnets **502**, **504**, located on the press and the coating unit, respectively, mate and attach the coating unit to the press. These electromagnets act to maintain the relative positions of the two units and therefore serve to replace latch pin **60**, lug **61**, and clevis **62**.

Before attaching the coating unit, a registering process is initiated. Registering refers to aligning the coating unit with the press in an operative position. More specifically, registering aligns the teeth of gear **66'** attached to the press impression cylinder **66** to those of another gear **40'** attached to the coating blanket cylinder **40**. Additionally, when the gears have been properly aligned, the sheet gripper is in its proper position relative to (and is registered with) the blanket gripper and gap on cylinder **40**. Proximity sensors **506**, **508** (or their equivalent) are attached to gear **66'** and gear **40'**, respectively, and are placed near the perimeter of the gears. Both gears **66'**, **40'** are rotated relative to one another until these sensors **506**, **508** are in their nearest proximity, indicating proper orientation. The gear teeth are then brought together in a mesh configuration, and index marks of FIG. **2** will be as shown.

Gear **40'**, attached to the coating blanket cylinder, is made of a resilient plastic material (i.e. MC901 Nylon). The purpose of manufacturing the gear out of plastic is to avoid problems associated with uneven gear wear. Metal gears in a gear train that have differencing amounts of wear may not mesh properly and may cause poor quality printing. Therefore, all metal gears in a gear train are usually replaced concurrently so that wear is matched for all gears in a set. A plastic gear on the retrofit blanket cylinder can adjust to the wear of the press gear **66'** because of its ductile and resilient qualities. Therefore, coating unit gear **40'** can be maintained independently of press gear **66'** and can be retrofitted or replaced independent of the state of wear of press gears without interfering with the quality of the printed material.

When the coating unit is locked to the press, it sometimes becomes necessary to realign the coated blanket cylinder **40** without separating the coating unit from the press. Therefore, both circumferential and lateral adjustments are possible.

Means for circumferential adjustments are illustrated in FIG. **10**. The gear **40'** attached to the coating blanket cylinder **40** includes a hub **650**. Atop the hub **650** is a face plate **652** which is secured to the coating blanket cylinder shaft **654** (shown on end view). Four bolts **658'**, attached to the hub **650** extend out of the hub through four machined slots **656** in the face plate **652**. Four nuts **658** are tightened on the bolts and are utilized to fasten the face plate **652** and shaft **654** to the gear hub **650**, thereby fixing the rotational orientation of the coating blanket cylinder **40** to the gear **40'**. To adjust the cylinder orientation with respect to the fixed gear position, the nuts **658** are loosened, and the face plate **656** and shaft **654** are rotated relative to the gear hub. Appar-

ently, the limits of rotation are defined by the circumferential length of the machined slots 656.

Means for lateral adjustments are illustrated in FIG. 11. Coating blanket cylinder 40 is attached to a shaft 654 at both ends. Gear 40' is mounted on one end of this shaft 654 (as described above). The lateral position of the cylinder 40 is maintained via shaft collars 600. The shaft collars 600 are placed on opposite ends of the shaft, and when secured, do not allow for lateral motion of the cylinder with respect to the shaft. Cylinder 40 is preferably keyed to the sheet 654 to prevent circumferential movement of the cylinders relative to the shaft. These collars have internal threads, and the shaft hollow tubes having an inner diameter is threaded externally.

Each shaft collar 600 includes inner screw threads which mate with outer screw threads 602 contained on the shaft 654. To move the cylinder 40 in a lateral direction, shaft collars 600 are loosened on the cylinder which specifically entails rotating these collars on their threads away from the cylinder, to free the cylinder to be laterally displaced on the shaft in either direction. When a desired position is achieved, the cylinder 40 is again tightened to the shaft 654 by rotating the shaft collars 600 on their threads toward the cylinder and into a tight fit against the cylinder. The force of the shaft collars against the cylinder act to lock the cylinder in a fixed lateral orientation relative to the shaft.

FIGS. 12a and 12b show the coating unit adapted for two different web offset presses to coat, e.g. with a U.V. coating). In FIG. 12a, press unit 701 is a single-sided web offset lithographic press, having a printing blanket cylinder 702 and an impression cylinder 703 for printing web workpiece 704. Coating unit 705 includes metering cylinder 706 and blanket cylinder 707, as described above.

In FIG. 12b, press unit 801 is a double sided (blanket-to-blanket) web offset lithographic press unit in which blanket cylinders 802 and 803 print opposite sides of web workpiece 804 simultaneously. Coating unit 805 operates in associating with blanket cylinder 803 to coat the top side of web 804.

OTHER EMBODIMENTS

Other embodiments are within the following claims. For example, other doctor blade arrangements may be used to doctor the coating from the transfer roller 10, such as a system utilizing a reverse angle blade or having dual blades and having a coating inlet between the two blades. A roll, or roller means, may also replace the doctor blade arrangement. Other types of engraved or smooth surfaced cylinders may be used. Those skilled in the art will appreciate that the coating unit described above may be adapted to achieve numbering, slitting, scoring, and the like. Moreover, the coating unit described above may be used to deliver varnishes, coatings, glues, dyes, etc. in addition to coatings. Other types of presses may be used in conjunction with the coater, but offset lithographic sheet-feeding presses are preferred. For example, the coating unit may be adapted to web offset press printing.

What is claimed is:

1. A coating apparatus for applying a liquid coating to a workpiece in co-operation with an impression cylinder mounted on a lithographic printing press, said press having at least one ink carrying surface for applying ink to said workpiece prior to coating, said coating apparatus comprising,

a) an independent, cooperatively operating coating assembly comprising:
   i) a liquid coating supply means;
   ii) a coating carrier which includes a resilient coating carrying surface for carrying liquid coating;
   iii) a means for metering and transferring liquid coating, operatively connected between said coating supply and said carrying surface, for maintaining a controlled amount of liquid coating on said coating carrying surface; and
   iv) structural members integrating said means for metering and transferring liquid coating and said coating carrier into said coating assembly;

b) supports for allowing movement of said coating assembly between: i) an operative position in which said coating surface on said carrying surface is in rotative pressure contact with a workpiece on said press unit impression cylinder; and ii) a fully retracted position in which said coating assembly is completely disengaged from said press unit impression cylinder at a location remote from the press unit impression cylinder, said coating assembly, including said coating carrier and said means for metering and transferring coating material, remaining connected during said movement;

whereby, in said operative position, said carrying surface continuously delivers a smooth, uniform, metered amount of said liquid coating material to said workpiece on said impression cylinder.

2. The coating apparatus of claim 1 in which said coating assembly comprises:

a) a roller means for metering and transferring a uniform predetermined quantity of coating to said resilient carrying surface on said coating carrier, said coating supply means being operatively associated with said roller means;

b) a movable support for said coating carrier, for moving said coating carrier into and out of contact with said workpiece on said impression cylinder;

c) a movable support for said roller means for moving said roller means into and out of contact with said coating surface on said coating carrier;

d) means for integrating said coating carrier and said roller means into said coating assembly;

e) means for independently actuating said coating carrier movement and said roller means movement;

f) means for independently adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder and pressure between said roller means and said coating surface on said coating carrier; and

g) means for integrating said coating assembly with said impression cylinder in said operative position, such that a change in pressure between said carrying surface on said coating carrier and said workpiece on said impression cylinder, or actuation of said carrier into and out of contact with said workpiece, does not alter pressure between said roller and said coating carrier; and such that a change in pressure between said roller means and said carrying surface on said coating carrier, or actuation of said roller means into and out of contact with said coating surface on said coating carrier, does not alter pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder.

3. The coating apparatus of claim 1 in which said coating assembly comprises:

a) support and retraction means for said coating assembly allowing movement of said coating assembly between at least three positions, a first position in which said coating surface on said coating carrier is operatively engaged with a workpiece on said press unit impression cylinder, a second (off-impression) position in which said coating surface on said coating carrier is separated somewhat from said workpiece on said press unit impression cylinder, and a third (storage) position in which said coating assembly is removed away from the impression cylinder, allowing access to said press; said coating assembly, including said means for metering and transferring coating material, remaining connected during movement of said coating carrier as part of said coating assembly.

4. The apparatus of claim 1, claim 2, or claim 3 wherein said impression cylinder is operatively associated with a printing blanket cylinder positioned in a printing unit of said printing press, whereby, in operation, a workpiece on said impression cylinder contacts said printing blanket at a first workpiece location while it contacts said coating surface on said coating carrier at a second workpiece location, enabling simultaneous printing and coating at said impression cylinder.

5. The apparatus of claim 1 wherein said coating assembly is mounted on an inclined support.

6. The apparatus of claim 1 further comprising a means for moving the coating assembly toward or away from the press unit.

7. The apparatus of claim 6 wherein the means for moving the coating assembly comprises a hydraulic cylinder.

8. The apparatus of claim 1 wherein said means for metering and transferring coating comprises a transfer cylinder in operative contact with said coating surface on said coating carrier and means for metering the amount of coating carried on said transfer cylinder.

9. The apparatus of claim 8 including means to control the nip between said transfer cylinder and said coating surface on said coating carrier.

10. The apparatus of claim 1 including a gear positively coupling said coating carrier to said impression cylinder when said coating assembly is in said first operating position.

11. The apparatus of claim 10 wherein said gear comprises a plastic material.

12. The apparatus of claim 1 wherein the impression cylinder comprises a gear adapted to drive a gear for the coating carrier.

13. The apparatus of claim 10 further comprising means of registering the gear for the coating carrier with the adjacent impression cylinder gear.

14. The apparatus of claim 13 further comprising sensors on said coating carrier gear and said impression cylinder gear to rotationally align said gears with one another

15. The apparatus of claim 1 further comprising means for adjusting the position of the coating carrier relative to the impression cylinder, while the coating carrier remains drivingly engaged with the impression cylinder.

16. The apparatus of claim 8 or 9 comprising an adjustable stop to control the nip between the coating surface on said coating carrier and the workpiece on said impression cylinder, without changing the coating carrier relationship to the liquid coating metering and transfer means.

17. The apparatus of claim 1 wherein said coating carrier further comprises means for register adjustment with the adjacent press impression cylinder.

18. The apparatus of claim 17 wherein the register adjustment comprises a plurality of bolts corresponding to slots, which cooperate to allow for movement of the coating carrier with respect to a gear for the coating carrier.

19. The apparatus of claim 17 wherein the coating carrier further has means enabling lateral register adjustment relative to the adjacent press impression cylinder.

20. The apparatus of claim 19 wherein the lateral register adjustment means comprises threaded collars adapted to allow for lateral movement of the coating carrier located at both ends of said coating carrier relative to a shaft extending through and supporting the carrier, said shaft being fixed against lateral movement.

21. The apparatus of claim 1 wherein said impression cylinder is retrofit into a position in said printing press ordinarily occupied by a workpiece transfer cylinder.

22. The apparatus of claim 21 in which said position of said impression cylinder is retrofit in place of a workpiece transfer cylinder positioned to transfer said workpiece to a fixed coater.

23. The apparatus of claim 1 wherein said printing press is connected to a fixed coater and said impression cylinder is an impression cylinder that forms part of said coater.

24. The apparatus of claim 1 further comprising a means of locking the coating assembly to the press unit.

25. The apparatus of claim 24 wherein the means of locking comprises a clevis and a press-mounted lug cooperatively sized and positioned to engage said clevis, and a releasable latch pin adapted to connect said clevis to said lug.

26. The apparatus of claim 24 wherein the means of locking comprises a pair of cooperatively sized and positioned electromagnets.

27. The apparatus of claim 2 comprising

means to positively rotate said roller means,

means to positively rotate said coating surface on said coating carrier in registration with said workpiece supported and conveyed on said impression cylinder,

sequencing means, cooperatively associated with the means for actuating, for sequentially actuating movement of said roller to said coating surface on said coating carrier, before actuating movement of said coating surface on said coating carrier to engage said printed workpiece on said impression cylinder, and for sequentially actuating movement of said roller away from said coating surface on said coating carrier before actuating movement of said coating surface on said coating carrier away from said workpiece.

28. The apparatus of claim 1 comprising means to vary the surface speed of at least one roller in the roller means relative to the surface speed of the carrier.

29. The apparatus of claim 1, claim 2, or claim 3, wherein said coating carrier is a coating blanket cylinder or a coating plate cylinder.

30. The apparatus of claim 1, claim 2, or claim 3, wherein said coating carrier presents a gapped coating surface to said impression cylinder as said impression cylinder rotates, and said printing ink carrier presents a gapped printing surface to said impression cylinder as said impression cylinder rotates, said coating surface

(including said gap therein) having a perimeter substantially equal to the perimeter of said printing surface (including said gap therein).

31. The apparatus of claim 1, claim 2 or claim 3 wherein the coating carrier is a coating plate cylinder carrying a plate.

32. The apparatus of claim 1, claim 2 or claim 3 wherein the impression cylinder is a standardly supplied impression cylinder supporting a workpiece being printed on a lithographic printing press unit.

33. The apparatus of claim 1, claim 2, or claim 3, wherein the impression cylinder is retrofit in place of a standardly supplied transfer cylinder on a lithographic printing press unit.

34. The apparatus of claim 2 wherein means supporting and integrating comprises a first pair of frames supporting said moveable support means for said carrier and said roller means, including said support actuating means and adjustment means, where said pair is minutely adjustable, actuatable and relocatable to a remote position from said impression cylinder, said impression cylinder being supported by a second pair of frames.

35. The apparatus of claim 34 wherein said actuation means for said first pair of frames include a pair of hydraulic cylinders.

36. The apparatus of claim 2 wherein said means for independently adjusting pressure includes stops and screws for adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, associated with means to limit pressure therebetween.

37. The apparatus of claim 2 wherein the roller means comprises an engraved anilox roll having an engraved cell structure with a maximum capacity of approximately 15 billion cubic microns per square inch for carrying a water-base acrylic coating having a solids content of approximately 45% to apply a dry coat weight to said sheet workpiece of approximately 0.4 to 0.6 lbs/1000 Ft^2 when the anilox roll has a surface speed approximating that of the resilient coating surface of the coating carrier.

38. Apparatus for applying a uniform and smooth liquid coating, on line, to a printed workpiece in a multi-color sheet-fed lithographic printing press wherein coating is applied to said workpiece while said workpiece is supported and conveyed by an impression cylinder of said press, said coating being applied over wet ink, said apparatus comprising:

a coating carrier supporting a resilient coating surface in rotative pressure contact with said printed sheet workpieces;

roller means for metering and transferring a uniform predetermined quantity of coating to said resilient coating surface on said coating carrier;

coating supply means operatively associated with said roller means;

means supporting said coating carrier, said roller means and said coating supply means, into a cooperatively operable coating assembly;

means to adjust pressure between said resilient surface on said coating carrier and said sheet workpiece:

means to adjust pressure between said roller means and said coating carrier;

means to rotate said coating carrier such that said resilient surface of said carrier rotates with said sheet workpiece to apply a uniform, smooth coating over wet ink on said sheet workpiece;

means to rotate said roller means;

means to actuate said coating carrier from said sheet workpiece to an off-impression position;

support and guide means for said coating assembly attached to said press;

and, means to retract said coating assembly including said coating carrier, said roller means and said coating supply means, to a remote position substantially away from said impression cylinder, to provide access to said press upon movement of said coating apparatus.

39. A method for printing and coating a workpiece, by transmitting said workpiece through a coating apparatus in cooperation with an impression cylinder mounted on a lithographic printing press, said coating apparatus comprising

a) an independent, cooperatively operating coating assembly comprising:

i) a liquid coating supply means;

ii) a coating carrier which includes a resilient coating carrying surface for carrying liquid coating;

iii) a means for metering and transferring liquid coating, operatively connected between said coating supply and said carrying surface, for maintaining a controlled amount of liquid coating on said coating carrying surface; and

iv) structural members integrating said means for metering and transferring liquid coating and said coating carrier into said coating assembly;

b) supports for allowing movement of said coating assembly between: i) an operative position in which said coating surface on said carrying surface is in rotative pressure contact with a workpiece on said impression cylinder; and ii) a fully retracted position in which said coating assembly is completely disengaged from said impression cylinder at a location remote from the impression cylinder, said coating assembly, including said coating carrier and said means for metering and transferring coating material, remaining connected during said movement;

whereby, in said operative position, said carrying surface continuously delivers a smooth, uniform, metered amount of said liquid coating material to said workpiece on said impression cylinder.

40. The method of claim 39 in which said impression cylinder is operatively associated both with a printing carrier at a first location on said workpiece and with said coating carrier at a second location on said workpiece, to simultaneously print and coat said workpiece at a single impression cylinder.

41. The method of claim 39 in which said printing press includes a coater for providing a U.V. curable coating, and said coating assembly coats with a pre-coat, prior to application of said U.V. curable coating by said coater.

42. The method of claim 39 in which said printing press includes a fixed coater comprising a fixed coater impression cylinder operatively connected to a coater blanket cylinder and to said coating assembly carrier, whereby said method comprises coating said workpiece with two coating layers at said fixed coater impression cylinder.

43. A method for applying a liquid coating to a workpiece, using a coating apparatus operating on line with an impression cylinder of a lithographic printing press,

said press having at least one ink carrying surface for applying ink to said workpiece prior to coating, said coating apparatus comprising: a) a coating carrier adapted to carry a resilient coating surface in rotative pressure contact with said workpiece supported by said impression cylinder; b) a roller means for metering and transferring a uniform predetermined quantity of coating to said resilient coating surface on said coating carrier; c) coating supply means operatively associated with said roller means; d) a movable support for said coating carrier for moving said coating carrier into and out of contact with said workpiece on said impression cylinder; and a movable support for said roller means for moving said roller means into and out of contact with said coating surface on said coating carrier; said coating carrier and said roller means being integrated into a unitary assembly; said method comprising:

a) independently actuating said coating carrier movement on the one hand and said roller movement on the other hand;
b) independently adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder and pressure between said roller means and said coating surface on said coating carrier; and
c) integrating said impression cylinder with said assembly, such that a change in pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, or actuation of said carrier into and out of contact with said workpiece, does not alter pressure between said roller means and said coating carrier; and such that a change in pressure between said roller means and said coating surface on said coating carrier, or actuation of said roller means into and out of contact with said coating surface on said coating carrier, does not alter pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder.

44. The apparatus of claim 4, wherein said coating carrier is a coating blanket cylinder or a coating plate cylinder.

45. The apparatus of claim 4, wherein said coating carrier presents a gapped coating surface to said impression cylinder as said impression cylinder rotates, and said printing ink carrier presents a gapped printing surface to said impression cylinder as said impression cylinder rotates, said coating surface (including said gap therein) having a perimeter substantially equal to the perimeter of said printing surface (including said gap therein).

46. The apparatus of claim 4, wherein the coating carrier is a coating plate cylinder carrying a plate

47. The apparatus of claim 4, wherein the impression cylinder is a standardly supplied impression cylinder supporting a workpiece being printed on a lithographic printing press unit.

48. The apparatus of claim 16 wherein said adjustable stop includes stops and screws for adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, associated with means to limit pressure therebetween.

49. Coating apparatus operating on line with an impression cylinder of a lithographic printing press to apply liquid coating to a workpiece, said press having at least one ink carrying surface for applying ink to said workpiece prior to coating, said coating apparatus comprising: a) a coating carrier adapted to carry a resilient coating surface in rotative pressure contact with said workpiece supported by said impression cylinder; b) a roller means for metering and transferring a uniform predetermined quantity of coating to said resilient coating surface on said coating carrier; c) coating supply means operatively associated with said roller means; d) a movable support for said coating carrier for moving said coating carrier into and out of contact with said workpiece on said impression cylinder; e) a movable support for said roller means for moving said roller means into and out of contact with said coating surface on said coating carrier; f) means for independently actuating said coating carrier movement on the one hand and said roller movement on the other hand; g) means for independently adjusting pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder and pressure between said roller means and said coating surface on said coating carrier; h) means for integrating said impression cylinder with said assembly, such that a change in pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder, or actuation of said carrier into and out of contact with said workpiece, does not alter pressure between said roller means and said coating carrier; and such that a change in pressure between said roller means and said coating surface on said coating carrier, or actuation of said roller means into and out contact with said coating surface on said coating carrier, does not alter pressure between said coating surface on said coating carrier and said workpiece on said impression cylinder;

said coating carrier and said roller means being integrated into a unitary assembly.

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[54] **APPARATUS AND METHOD FOR CONTROLLING TEMPERATURE OF PRINTING PLATE ON CYLINDER IN ROTARY PRESS**

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[21] Appl. No.: **795,945**

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[51] **Int. Cl.**[5] **B41F 23/04**

[52] **U.S. Cl.** **101/487**; 101/349; 101/216; 165/89

[58] **Field of Search** 101/487, 424.1, 349, 101/350, 216; 165/89, 36, 30; 236/12.13; 34/13, 62

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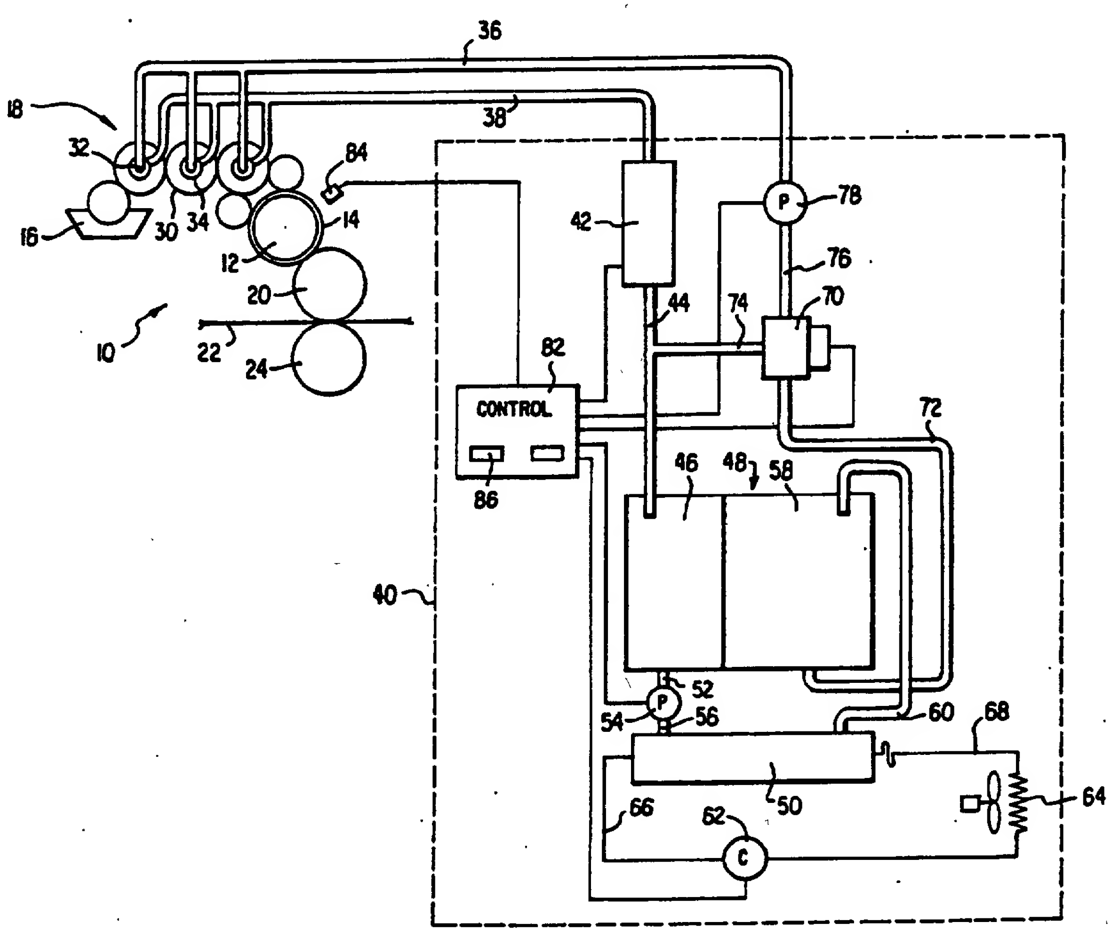
[57] **ABSTRACT**

In a rotary press, temperature of a printing plate is sensed by an infrared temperature sensor mounted in close proximity to a cylinder carrying the printing plate. Sensor output is used to control a closed loop of a water circulating system which includes one or more water-carrying rollers in an ink train. A water cooler and a water heater are provided in the closed loop and are controlled in response to the sensor output to maintain the printing plate at a temperature which allows proper inking thereof.

8 Claims, 1 Drawing Sheet



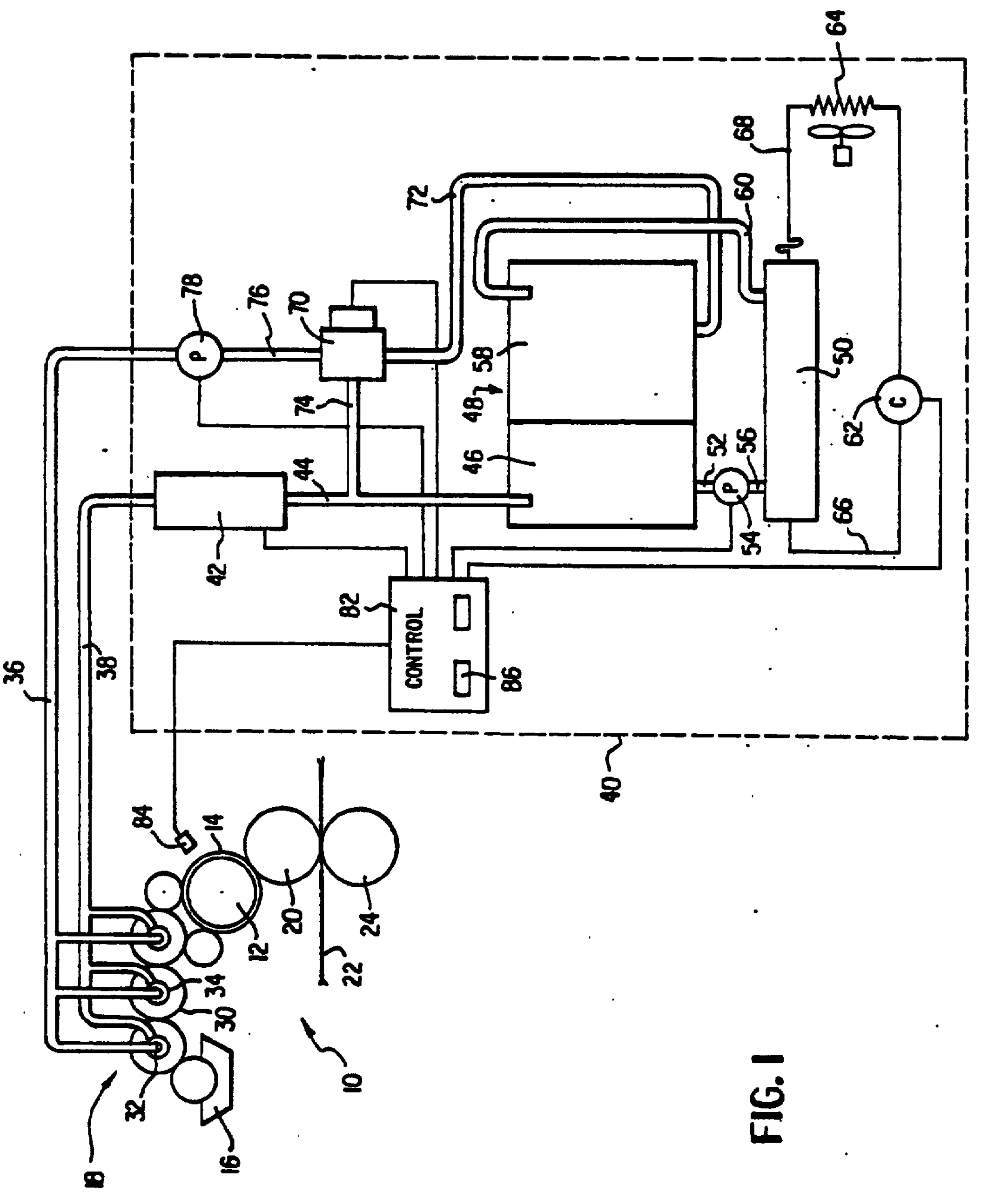

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FIG. I

APPARATUS AND METHOD FOR CONTROLLING TEMPERATURE OF PRINTING PLATE ON CYLINDER IN ROTARY PRESS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to rotary printing presses and, more particularly, to the control of the temperature of the plate on a cylinder in such presses.

2. Description of the Related Art

The temperature of the plate on a cylinder of a rotary printing press is important in maintaining printing quality as the ability to achieve proper inking of the plate is related to temperature. If the plate temperature is too high, the ink viscosity drops. Thus, the ink breaks down and tends to adhere to the nonimage bearing areas of the plate. Improper inking may also occur when the plate temperature is too low.

U.S. Pat. No. 2,971,460 issued to Shindle in 1961 and discloses a system for controlling ink roller temperature in a printing press by means of water circulating through the hollow interior of the rollers. This system is primarily concerned with heating of the rollers with heat extracted from web cooling rollers. When cooling of the inking rollers is necessary, the system relies on the use of cold water from an external source with the subsequent discharge of the water to a drain. However, such an open circulation system is wasteful of water.

Temperature control in the Shindle system is by way of thermostatic valves which are responsive to the water temperature which is, effectively, only an indirect measurement of the inking roller temperature.

Modern rotary presses and the inks used therewith are such that cooling, rather than heating, of the inking train and printing plate has primary importance. It is, accordingly, a primary object of the present invention to provide a system for effecting such cooling in an efficient, water-conserving manner.

In the printing process, the critical temperature for proper inking is that of the printing plate itself. It is also a principal object of the present invention to provide a temperature control system which is directly responsive to the plate temperature.

A further object of the invention is the provision of such a temperature control system which is capable of either cooling or heating the printing plate.

SUMMARY OF THE INVENTION

The above and other objects of the invention will become apparent hereinafter and are achieved by the provision of a plate temperature control system for a rotary printing press. This system includes a closed loop water circulating system including one or more, preferably three, hollow, water-carrying rollers in the ink train of the press, a water heater, a water cooler, a controlled mixing valve, and a circulating pump; an electrical control system for the water heater, water cooler, mixing valve and pump; and an infrared temperature sensor being mounted in close proximity to the plate cylinder of the press to detect its temperature. The sensor also provides input to the control system.

For a more complete understanding of the invention and the objects thereof, reference should be made to the accompanying drawing and the following detailed description wherein a preferred embodiment of the invention is illustrated and described.

DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1, the sole FIGURE, is a schematic showing of a rotary printing press and the plate temperature control system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Generally, a rotary offset printing press **10**, with the exception of the temperature control system of the present invention, has a conventional design and construction. Such a press **10** includes a plate cylinder **12** which carries, on the circumferential face thereof, a printing plate **14**. Ink is furnished to the plate **14** from a fountain **16** by way of an ink train **18** consisting of a plurality of inking rollers **30**. As is well known, the plate **14** is etched so as to be ink receptive only in those areas which are to be printed. From the plate **14**, the ink is transferred to a blanket cylinder **20** and then to a sheet or web **22** of paper or the like brought into contact therewith by an impression cylinder **24**.

As was discussed above, proper inking of the plate **14**, so as to provide quality printing, is dependent, in part, on the ink temperature as it is applied to the plate **14**. Excessive temperature causes a lowering of ink viscosity and a break down of the ink with smearing of the ink onto the nonprinting regions of the plate **14**. Improper inking of the plate **14** may also occur when the ink temperature is too low, as may be the case during start-up or after the press **10** has been shutdown for a long period of time.

In accordance with the present invention, a closed loop water circulating system responsive to the temperature of the printing plate **14** is provided to maintain the desired plate temperature and, accordingly, the temperature of the ink applied thereto. In this system, one or more, preferably three, of the rollers **30** of the ink train **18** are hollow and are provided with rotary water inlet and outlet connections **32** and **34**, respectively, whereby water is circulated within the rollers **30** in heat exchange therewith. The details of such rollers **30** and rotary connections **32** and **34** are well known and need not be further described herein.

Supply and return conduits **36** and **38**, respectively, connect the rollers **30** to a water circulating and cooling/heating unit **40**. Water entering the unit **40** from conduit **38** flows first through a water heater **42** which is, preferably, a flow-through electric heater, to a pipe **44** leading to an inlet chamber **46** of a dual chamber reservoir **48**. A water chiller **50** has its inlet connected to the inlet chamber **46** by a pipe **52**, a first circulating pump **54**, and a pipe **56**. The water chiller **50** has its outlet connected to an outlet chamber **58** of the reservoir **48** by a pipe **60**. The chiller **50** is connected to a refrigeration system including a compressor **62** and a condenser **64** via refrigerant lines **66** and **68**, respectively. A controllable mixing valve **70** has its first inlet connected by piping **72** to the outlet chamber **58** of the reservoir **48** and its second inlet connected to a pipe **74** which branches from the pipe **44**. The outlet of the valve **70** is connected by piping **76** to a second circulating pump **78** which, in turn, has its outlet connected to the supply conduit **36**.

The cooling/heating unit **40** is capable of circulating either cooled or heated water through the rollers **30** of the ink train **18** in order to maintain the ink at the desired temperature for proper inking of the plate **14**.

Operation of the unit 40 is regulated by an electrical control unit 82 in accordance with the temperature of the printing plate 14. A plate temperature sensor 84 provides an input to the control unit 82. In the preferred embodiment, this sensor 84 is an infrared sensor mounted in close proximity to the periphery of the printing plate 14 of the cylinder 12, preferably midway between the ends thereof. It will be appreciated, however, that other types of sensors for detecting the temperature of the printing plate 14 may be employed. The control unit 82 is provided with an appropriate input device 86 by which the desired plate temperature is supplied manually by an operator of the printing press 10.

The operation of the invention will now be described. When the press 10 is initially started, the cylinders 12 and the rollers 30 may be such that the plate temperature is lower than desired. Under these circumstances, the control unit 82 activates the second circulating pump 78 and the water heater 42. The unit 82 also energizes the mixing valve 70 so that water is circulated through the heater 42, the pipe 44, the branch pipe 74, and the pipe 76 to the second circulating pump 78 to supply heated water to the conduit 36 for circulation through the hollow ink rollers 30.

As the plate temperature rises due both to heat supplied by the unit 40 and also due to frictionally generated heat occurring during operation of the press 10, cooling of the printing plate 14 becomes necessary to maintain the desired inking temperature. In the cooling mode of the unit 40, the heater 42 is turned off while the chiller 50 is activated to maintain a supply of cooled water in the outlet chamber 58. The mixing valve 70, under control of the control unit 82, regulates the temperature of the water supplied to the inking rollers 30 through the conduit 36 by proportioning the amount of cooled water from the chamber 58 with the amount of warm water returning from the rollers 30 through the conduit 38 and the branch pipe 74. By way of example, if a plate temperature of 60° F. is desired, the temperature of the water supplied is about 48° F. as will be apparent to those skilled in the art, the temperatures are dependent on several factors, including the speed of the operating press 10 and the amount of ink coverage.

While, in the illustrated embodiment, the cooling-/heating unit 40 is an integrated unit, it may be preferable to have the reservoir 48 and the water chiller 50 located separately from the remainder of the unit 40. The space available for installation, as well as other factors, determine the particular configuration.

As these and other changes may be made in the described embodiment of the invention without departing from the spirit thereof, reference should be had to the appended claims in determining the true scope of the invention.

What is claimed is:

1. A temperature control system for a printing plate of a rotary press of a type having a cylinder, said printing plate being carried on the cylinder, and an ink train including a plurality of ink rollers, at least one of which rollers is hollow and equipped with connections for circulating water in a heat exchange relationship therethrough, said system comprising:

a water circulating unit including a two-chambered water reservoir, two circulating pumps, a water chiller, a water heater and a controllable mixing valve, said circulating unit being connected to the hollow roller to provide a closed loop water circulating path;

temperature sensing means for detecting a temperature of the printing plate and also for generating a signal corresponding to a detected plate temperature; and

means, responsive to the signal, for controlling the circulating unit so as to regulate a temperature of the water circulating through the closed loop path in accordance with the detected plate temperature.

2. The temperature control system of claim 1 wherein said temperature sensing means comprises an infrared temperature sensor mounted in close proximity to the cylinder.

3. A temperature control system for a printing plate of a rotary press of a type having a cylinder, said printing plate being carried on the cylinder, and an ink train including a plurality of ink rollers, at least one of which rollers is hollow and equipped with connections for circulating water in a heat exchange relationship therethrough, said system comprising:

a water circulating unit including a circulating pump, a water chiller, and a controllable mixing valve, said circulating unit being connected to the hollow roller to provide a closed loop water circulating path;

temperature sensing means for detecting a temperature of the printing plate and also for generating a signal corresponding to a detected plate temperature; and

means, responsive to the signal, for controlling the circulating unit so as to regulate a temperature of the water circulating through the closed loop path in accordance with the detected plate temperature;

wherein said temperature sensing means comprises an infrared temperature sensor mounted in close proximity to the cylinder;

wherein the circulating unit further includes a water heater; and

wherein the circulating unit further includes a reservoir having a first chamber receiving water returned from the roller and also having a second chamber, said water chiller being connected between the first chamber and the second chamber, said mixing valve having a first inlet connected to the second chamber for receiving cooled water therefrom and also having a second inlet for receiving water returned from the roller, said mixing valve being operable to proportion water flow through the first inlet and the second inlet in accordance with a desired water temperature.

4. A temperature control system for a printing plate of a rotary press of a type having a cylinder, said printing plate being carried on the cylinder, and an ink train including a plurality of ink rollers, at least one of which rollers is hollow and equipped with connections for circulating water in a heat exchange relationship therethrough, said system comprising:

a water circulating unit including a circulating pump, a water chiller, and a controllable mixing valve, said circulating unit being connected to the hollow roller to provide a closed loop water circulating path;

temperature sensing means for detecting a temperature of the printing plate and also for generating a signal corresponding to a detected plate temperature; and

means, responsive to the signal, for controlling the circulating unit so as to regulate a temperature of the water circulating through the closed loop path in accordance with the detected plate temperature;

wherein the circulating unit further includes a water heater; and

wherein the circulating unit further includes a reservoir having a first chamber receiving water returned from the roller and also having a second chamber, said water chiller being connected between the first chamber and the second chamber, said mixing valve having a first inlet connected to the second chamber for receiving cooled water therefrom and also having as second inlet for receiving water returned from the roller, said mixing valve being operable to proportion water flow through the first inlet and the second inlet in accordance with a desired water temperature.

5. A temperature control system for a printing plate of a rotary press of a type having a cylinder, said printing plate being carried on the cylinder, and an ink train including a plurality of ink rollers, at least one of which rollers is hollow and equipped with connections for circulating water in a heat exchange relationship therethrough, said system comprising:

a water circulating unit including a circulating pump, a water chiller, and a controllable mixing valve, said circulating unit being connected to the hollow roller to provide a closed loop water circulating path;

temperature sensing means for detecting a temperature of the printing plate and also for generating a signal corresponding to a detected plate temperature; and

means, responsive to the signal, for controlling the circulating unit so as to regulate a temperature of the water circulating through the closed loop path in accordance with the detected plate temperature;

wherein the circulating unit further includes a reservoir having a first chamber receiving water returned from the roller and also having a second chamber, said water chiller being connected between the first chamber and the second chamber, said mixing valve having a first inlet connected to the second chamber for receiving cooled water therefrom and also having a second inlet for receiving water returned from the roller, said mixing valve being operable to proportion water flow through the first inlet and the second inlet in accordance with a desired water temperature.

6. A method of controlling a temperature of a printing plate of a rotary press of a type having a cylinder, said printing plate being carried on the cylinder, said rotary press having an ink train with a plurality of ink rollers, at least one of which is hollow and equipped with connections for circulating water in a heat exchange relationship therethrough, said method comprising the steps of:

pumping circulating water in a closed loop path from a two-chambered water reservoir to a controllable mixing valve through at least one hollow roller and back to the water reservoir;

measuring the temperature of the printing plate via a sensor;

generating from the sensor a signal corresponding to a measured plate temperature; and

controlling temperature of the circulating water via a water heater and a water chiller in response to the signal corresponding to the measured plate temperature.

7. A temperature control system for a printing plate of a rotary press of a type having a cylinder, said printing plate being carried on the cylinder, and an ink train including a plurality of ink rollers, at least one of which rollers is hollow and equipped with connections for circulating water in a heat exchange relationship therethrough, said system comprising:

a water circulating unit including a two-chambered water reservoir, two circulating pumps, a water chiller, a water heater, and a controllable mixing valve, said circulating unit being connected to the hollow roller to provide a closed loop water circulating path;

temperature sensing means for detecting a temperature at a selected point of the rotary press and also for generating a signal corresponding to a detected temperature at the selected point; and

means, responsive to the signal, for controlling the circulating unit so as to regulate a temperature of the water circulating through the closed loop path in accordance with the detected temperature at the selected point.

8. A method of controlling a temperature of a printing plate of a rotary press of a type having a cylinder, said printing plate being carried on the cylinder, said rotary press having an ink train with a plurality of ink rollers, at least one of which is hollow and equipped with connections for circulating water in a heat exchange relationship therethrough, said method comprising the steps of:

pumping circulating water in a closed loop path from a two-chambered water reservoir to a controllable mixing valve through at least one hollow roller and back to the water reservoir;

measuring the temperature at a selected point of the rotary press via a sensor;

generating from the sensor a signal corresponding to a measured temperature at the selected point; and

controlling temperature of the circulating water via a water heater and a water chiller in response to the signal corresponding to the measured temperature at the selected point.

* * * * *

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US005209179A

United States Patent [19]

Herbert et al.

[11] Patent Number: 5,209,179

[45] Date of Patent: May 11, 1993

[54] LIQUID COATING APPARATUS FOR USE IN CONJUNCTION WITH PRINTING PRESSES WHERE ACCESS OF THE COATING APPARATUS TO THE PRESS CYLINDERS IS RESTRICTED

[75] Inventors: John C. Herbert, Huntington Bay, N.Y.; Frank A. Andaloro, Pawcatuck, Conn.

[73] Assignee: Herbert Products, Inc., Westbury, N.Y.

[21] Appl. No.: 709,750

[22] Filed: Jun. 4, 1991

[51] Int. Cl.^{5} B05C 1/02

[52] U.S. Cl. 118/46; 118/249; 118/257; 118/231; 101/DIG. 48

[58] Field of Search .... 118/46, 211, 219, 221, 118/231, 249, 257; 101/DIG. 33, DIG. 48

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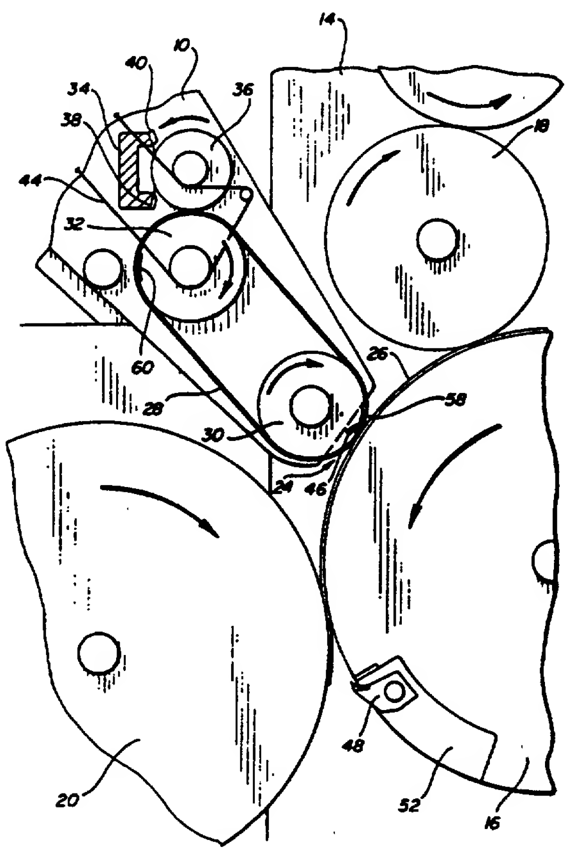
Primary Examiner—W. Gary Jones
Assistant Examiner—Todd J. Burns
Attorney, Agent, or Firm—Hoffmann & Baron

[57] ABSTRACT

A liquid coating apparatus capable of applying a liquid coating fluid to a workpiece traveling over a press cylinder rotatably mounted in a printing press is provided. The coating apparatus includes an applicator means which communicates with the press cylinder to form a nip site when the coating apparatus is in a operative position. The applicator means transfers the liquid coating fluid from the coating apparatus to a workpiece that has been caused to travel through the nip site. The applicator means includes an endless coating plate belt driveably mounted upon two support rollers, thereby affording communication of the endless coating plate belt with a press cylinder which has limited access to its surface.

16 Claims, 4 Drawing Sheets



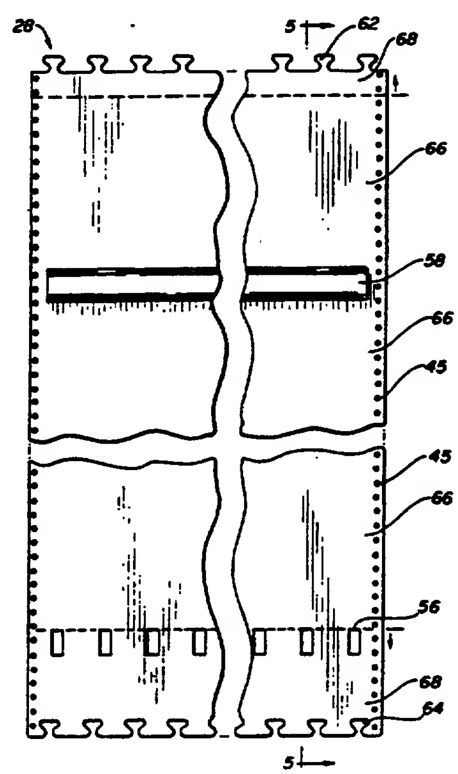
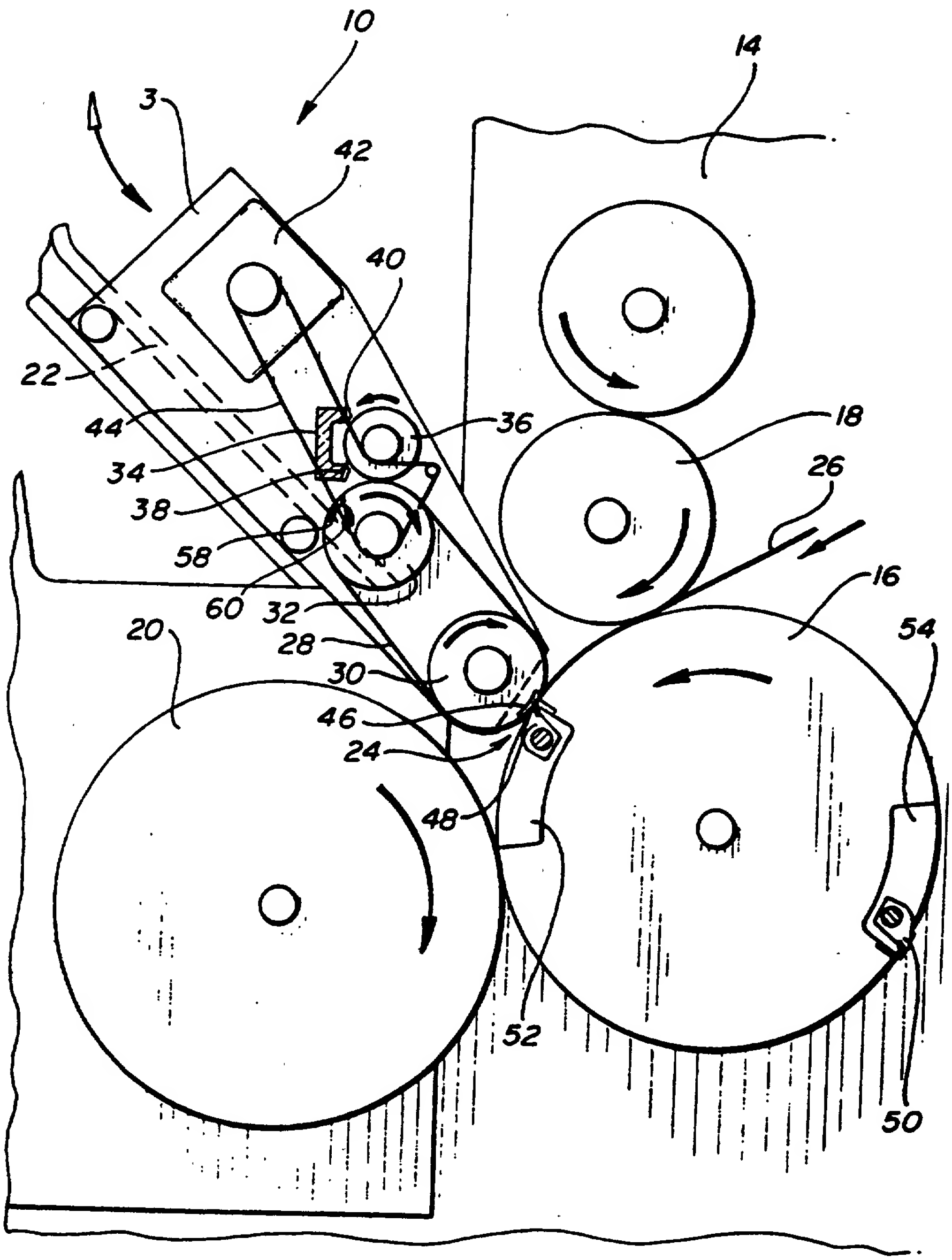


FIG-1



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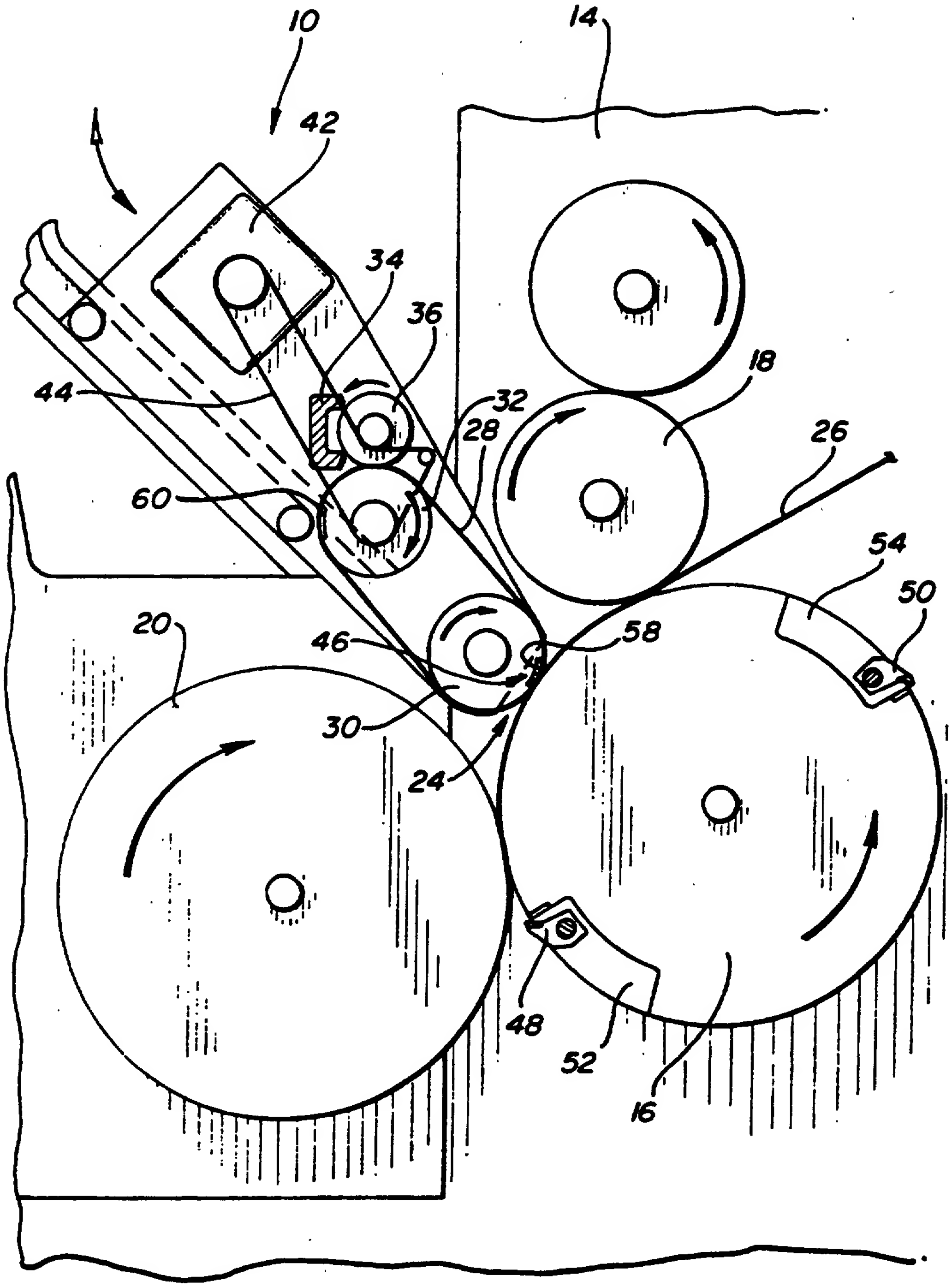

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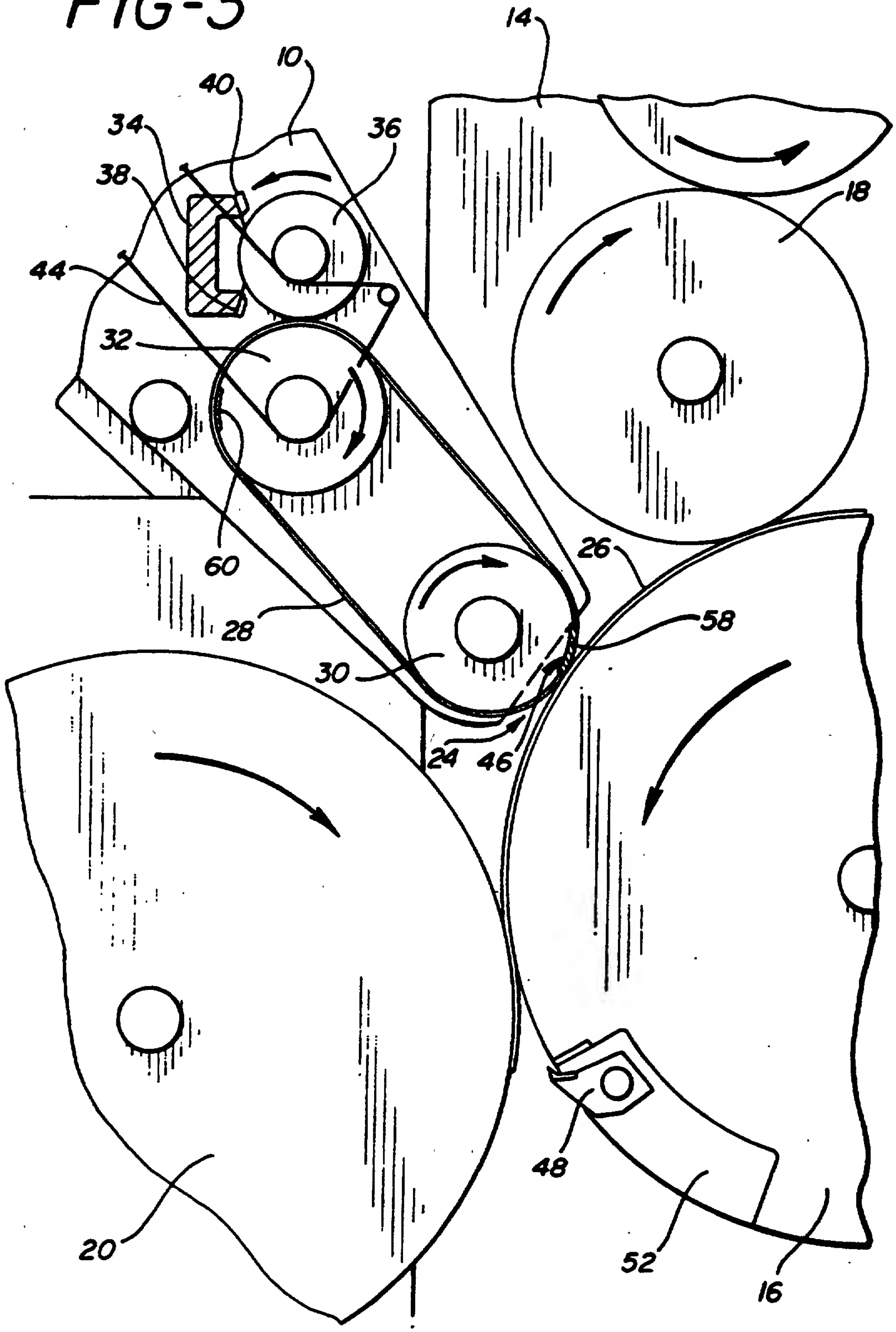
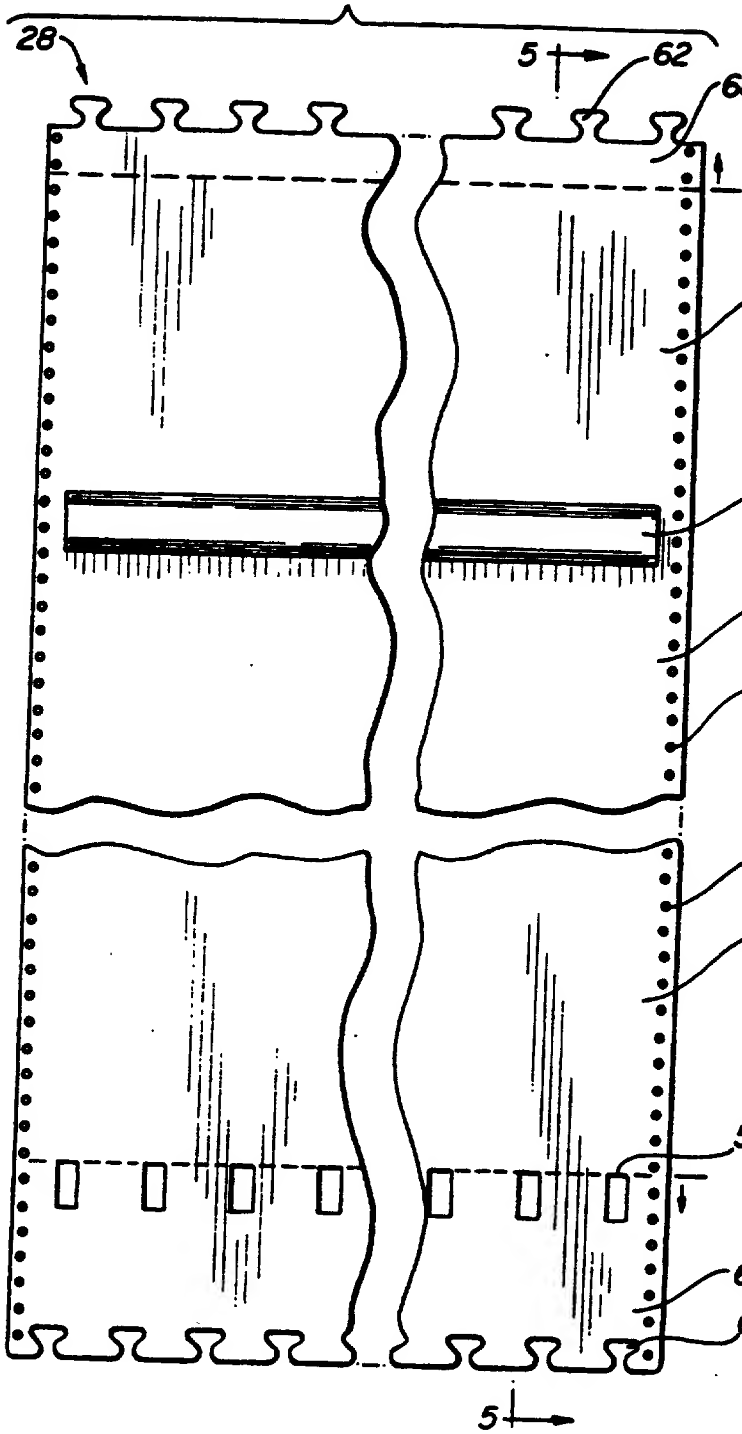


FIG-4



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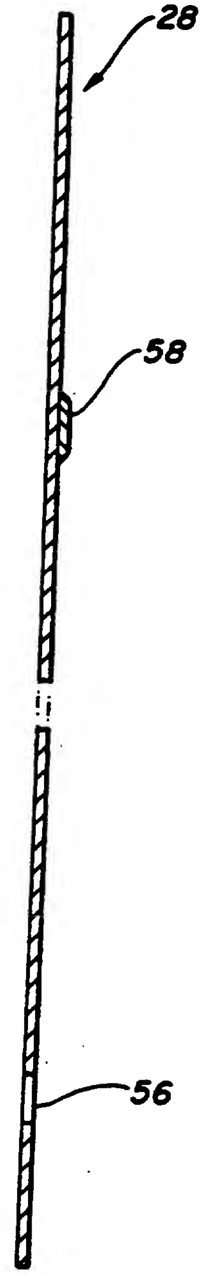

LIQUID COATING APPARATUS FOR USE IN CONJUNCTION WITH PRINTING PRESSES WHERE ACCESS OF THE COATING APPARATUS TO THE PRESS CYLINDERS IS RESTRICTED

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the printing industry and in particular to coating apparatus used in conjunction with printing presses for the application of liquid coating fluid to the surface of a workpiece. In particular, the present invention relates to coating apparatus which apply a liquid coating fluid to a workpiece while the workpiece travels over a press cylinder rotating in a printing press. More particularly, the present invention relates to coating apparatus for applying a liquid coating fluid to a workpiece on a press cylinder where access to the surface of the cylinder is restricted due to the orientation of adjacent cylinders operating in the printing press.

2. Description of the Prior Art

In many situations in the printing industry, it is desirable to apply a liquid coating fluid to the surface of a workpiece as it travels through a printing press. In order to achieve this objective, it is necessary to position a coating apparatus in sufficient proximity to the printing press so that the applicator means of the coating apparatus can contact the workpiece and apply the coating fluid as the workpiece moves over one of the press cylinders. Once the applicator means comes in contact with the press cylinder, a "nip" is formed through which the workpiece can travel.

In the printing industry, there are several types of printing presses having press cylinders which are oriented within the press frame in such a manner that access to their surface is limited. Consequently, problems have arisen when artisans have attempted to position a coating apparatus within sufficient proximity to the printing press so that the applicator means of the coating apparatus can form a "nip" with a particular press cylinder in the press.

These problems are mostly due to spacial constraints imposed by other press cylinders which are adjacent to the particular press cylinder sought to be contacted. For example, in one commercially available printing press (manufactured by the Komori Corporation, Tokyo, Japan), the impression cylinder is positioned between a blanket cylinder and a delivery or transfer cylinder in a configuration that severely restricts access to the surface of the impression cylinder. Consequently, existing coating assemblies cannot be used with such presses where contact with the impression cylinder is desired since the diameter of the applicator roller of these assemblies is too large to clear the space between the blanket cylinder and the delivery or transfer cylinder.

It is therefore an object of the present invention to provide for a coating apparatus which can be used in conjunction with a printing press to apply a liquid coating fluid to a workpiece traveling on a press cylinder having restricted access to its surface.

SUMMARY OF THE INVENTION

The present invention is a liquid coating apparatus operable in conjunction with either a sheet-fed or a web-fed printing press and is capable of applying a liquid coating fluid to a workpiece while the workpiece travels over the surface of a press cylinder rotating within the press. The present invention is especially advantageous when attempting to apply coating fluid to a workpiece traveling upon a press cylinder having restricted access to its surface.

The coating apparatus of the present invention includes a driveable support means capable of supporting an endless coating plate belt which functions to transfer liquid coating fluid from the coating apparatus to the workpiece. The coating plate belt is both supported and driven by the driveable support means. The coating apparatus also includes means for driving the driveable support means such that the coating plate belt is caused to be driven about the support means. A supply means is included to supply the liquid coating fluid to the belt while a metering means is employed to meter the supply of liquid coating fluid being supplied to the belt.

For a better understanding of the present invention, together with other and further objects, reference is made to the following description, taken together with the accompanying drawings and its scope will be pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the coating apparatus of the present invention shown in communication with a sheet-fed printing press.

FIG. 2 is a side elevational view of the coating apparatus of FIG. 1 wherein the coating plate belt is shown at a different point in its rotation about the driveable support means.

FIG. 3 is a side elevational view of the coating apparatus shown in FIG. 2 enlarged to show the nip site present between the coating apparatus and the printing press.

FIG. 4 is a plan view of the coating plate belt of the present invention shown from the backside of the belt.

FIG. 5 is a side elevational view of the coating plate belt of FIG. 4.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT OF THE INVENTION

Referring to FIGS. 1–4, the preferred embodiment of a coating apparatus 10 of the present invention is provided. Referring to FIG. 1, the coating apparatus 10 is shown positioned adjacent to a printing press 14. The printing press 14 includes a printing press cylinder 16 which is typically either a blanket or an impression cylinder. Press cylinder 16 has limited access to its surface due to adjacent press cylinders 18 and 20.

Retraction means 22 is provided for moving the coating apparatus into and out of an adjoining relationship with press cylinder 22 at nip site 24. In the operative position, the coating apparatus forms a "nip" with press cylinder 16 through which a workpiece 26 may pass.

Coating apparatus 10 includes an endless coating plate belt 28 which is supported by and trained about a first roller 30 and a second roller 32, both mounted for rotation within coating apparatus frame 33.

The coating belt 28 delivers liquid coating fluid to workpiece 26 as the workpiece travels through nip site 24 mounted about cylinder 16. Coating fountain 34 supplies liquid coating fluid to anilox roller 36 which, in turn, transfers the coating fluid from the fountain to coating belt 28. Doctor blades 38 and 40 are coupled to coating fountain 34 to meter the supply of coating fluid

transferred to coating belt 28 via anilox roller 36. The liquid coating supply means can be of any suitable type known in the art. Additionally, other methods known in the art for transferring and metering the coating supply to be received by coating belt 28 could alternatively be employed. The combination of an anilox roller and a doctor blade is merely exemplary of one such approach.

As previously mentioned, a first roller 30 and a second roller 32 provide support for coating plate belt 28. Roller 30 is referred to as a pressure roller since it provides the coating plate belt 28 with support at nip site 24, thereby affording sufficient "back pressure" against workpiece 26 as it moves through the nip. Roller 32 is referred to as a transfer roller since it provides the coating belt with support at the point where the coating belt receives coating fluid that has been transferred by anilox roller 36.

Coating plate belt 28 is trained around the pressure and transfer rollers for movement about the rollers. At least one of the rollers is driveably coupled to a motor or some other drive means. In the preferred embodiment of the present invention, transfer roller 32 is driveably coupled to motor 42 by way of drive train belt 44 enabling transfer roller 32 to undergo rotation upon activation of motor 42. Coating belt 28 is driveably coupled to transfer roller 32 such that rotation of the roller drives the coating belt about both pressure roller 30 and transfer roller 32.

In the preferred embodiment of the present invention, pressure roller 30 is not coupled to drive train belt 44, but rather rotates via a drive coupling (not shown) with coating plate belt 28. This drive coupling can be of any suitable type known in the art. For example, FIG. 4 shows coating plate belt 28 having track holes 45. These track holes communicate with sprocket assemblies (not shown) on rollers 30 and 32.

Referring to FIGS. 1–4, transfer roller 32 undergoes rotation via drive train belt 44. A sprocket assembly (not shown) coupled to transfer roller 32 rotates engaging track holes 45 on coating plate belt 28, thereby imparting movement to the coating belt. Consequently, coating plate belt 28 undergoes movement and imparts rotation to pressure roller 30 upon communication of track holes 45 with a sprocket assembly (not shown) coupled to roller 30. Alternatively, drive train belt 44 can be driveably coupled to pressure roller 30, leaving transfer roller 32 to undergo rotation via movement of coating belt 28.

Another drive train configuration (not shown) can also be employed utilizing an auxiliary drive coupling between transfer roller 32 and pressure roller 30. In this configuration, drive train belt 44 is operatively coupled to one of the rollers at one side while the auxiliary drive coupling is coupled to the other side. The auxiliary drive coupling is also coupled to the other roller, thereby imparting rotation to the other roller and alleviating drive stress on the coating plate belt 28.

In the preferred embodiment of the present invention, the rollers of the coating apparatus are driven by an independent drive means, such as motor 42. Alternatively, the rollers of the coating apparatus could be driven by a positive coupling to the printing press drive train, thereby avoiding the need for an independent motor assembly.

Although the present invention is capable of applying liquid coating fluid to a workpiece traveling over a press cylinder in either a web-fed or an individual sheet-fed press, the preferred embodiment shown in FIGS. 1–4 includes structure for operation in conjunction with the latter.

In particular, pressure roller 30 includes a notch or recessed area 46 formed or cut into its surface as shown in FIGS. 1–3. Recessed area 46 should have sufficient dimensions to accommodate the height of gripper 48 and gripper 50 as they pass through the nip site 24.

In sheet-fed printing presses, individual workpieces travel through the press, one sheet at a time. Consequently, press cylinders employed in these presses have "grippers" positioned at various points along their surfaces in order to transfer and guide the individual sheets from cylinder to cylinder. Generally, grippers function by grabbing and retaining the leading edge of an individual sheet until the sheet is subsequently passed to an adjacent cylinder. Each gripper has a series of finger-like projections extending outwardly from and positioned longitudinally along the body of the gripper to perform the "grabbing" and "retaining" function.

A gripper is typically positioned in a cylinder gap or trough so that it does not create an obstruction when the cylinder rotates the gripper into contact with an adjacent cylinder. For example, in FIGS. 1–3, grippers 48 and 50 are shown residing in cylinder gaps 52 and 54, respectively. Although most of the gripper body resides in the recessed cylinder gap, a portion of the gripper fingers extending from each gripper must protrude slightly above the surface of the cylinder on which the gripper is positioned in order to effectively "grab" the leading edge of the sheet. Consequently, there must be a notch or recessed area residing somewhere along a portion of the surface of any cylinder which abuts another cylinder having a gripper. This notch or recessed area must be of sufficient depth to accommodate that portion of the gripper protruding above the surface of the cylinder on which it resides

Generally, impression and transfer cylinders of sheet-fed printing presses are equipped with grippers while any blanket and/or other cylinders which abut impression or other cylinders having grippers include recessed areas in their surfaces to accommodate the grippers.

Referring to FIGS. 1–3, coating plate belt 28 is shown passing between pressure roller 30 and press cylinder 16 in order to transfer the liquid coating fluid to workpiece 26 as it passes through the nip site 24. Referring briefly to FIG. 4, coating plate belt 28 includes gripper slots 56 formed through the thickness of the belt and positioned across the width of the belt. When coating belt 28 is initially mounted about rollers 30 and 32, it should be oriented so as to align the gripper slots 56 over the recessed area 46 of the pressure roller 30.

Furthermore, the orientation of the coating plate belt about rollers 30 and 32 should be such that the gripper slots 56 are aligned over recessed area 46 at a preselected angular rotational position of pressure roller 30. More particularly, gripper slots 56 should pass through nip site 24 simultaneously and in alignment with recessed area 46 so as to accommodate the height of grippers 48 and 50. Consequently, gripper slots 56 should be of sufficient number and should have dimensions for accommodating the gripper-fingers (not shown) of grippers 48 and 50. Insufficient slot size or misalignment of the slots and recessed area 46 may damage the coating plate belt or the grippers.

In addition to providing for an alignment of gripper slots 56 with recessed area 46 on pressure roller 30 in order to accommodate any grippers which may be pres-

ent on press cylinder 16, coating plate belt 28 must be sized in accordance with the press cylinder to which it abuts to form a nip when the coating apparatus is being used in conjunction with a sheet-fed press or during spot-coating operations performed on either a sheet-fed or web-fed press.

For example, in a sheet-fed printing press, individual sheets are transferred from press cylinder to press cylinder as they move through the press. As previously mentioned, these individual sheets or workpieces are often retained on the surface of these cylinders by grippers which grab the leading edge of the workpiece. The number of sheets that can be retained on the surface of any one cylinder at any one instant in time depends upon the number of grippers available on the cylinder, the circumferential diameter available on the cylinder surface against which the sheets are supported and the length of the individual sheets. Cylinder gaps recessed in the surface of these cylinders for housing the grippers do not provide for a supporting surface against which a workpiece can rest and consequently result in what is referred to as "dead space" on the cylinder surface.

For example, the area of a press cylinder surface between the trailing edge of one workpiece and the leading edge of another workpiece would constitute "dead space". Obviously, in coating operations where the coating apparatus is contacting a press cylinder to deliver coating fluid to a workpiece, it would be undesirable to have the coating plate belt deliver coating fluid to the nip when there is no workpiece present to receive the coating fluid.

Consequently, when the coating apparatus of the present invention is used in conjunction with a sheet-fed printing press or in spot coating operations, the coating plate belt must be sized in order to accommodate individual sheet length as well as individual sheet width. Additionally, the belt length must also include "no print" areas where coating fluid is absent from the belt. These "no print" areas must be coordinated with "dead space" present on the press cylinder.

Accordingly, the length of the coating plate belt of the present invention is either equivalent to or an inverse multiple of the circumferential measurement of the press cylinder to which it abuts. For example, in the preferred embodiment of the present invention, coating plate belt 28 has a length which is one half the circumferential measurement of press cylinder 16. Consequently, for every complete rotation of press cylinder 16, coating belt 28 makes two complete revolutions around rollers 30 and 32.

Alternatively, in overall coating or full-coverage coating operations performed on a web-fed press, a continuous web of material receives a uniform, unbroken application of coating fluid. Consequently, if the present invention were to be employed in such a procedure, considerations regarding belt length and the strategic positioning of "no print" regions along the length of the belt would be of minor concern.

Referring to FIG. 1, workpiece 26 is shown with its leading edge held in position at nip site 24 by gripper 48. Recessed area 46 is present at the nip site to accommodate the portion of gripper 48 which extends above the surface of press cylinder 16. As previously mentioned, it is necessary to have the recessed area 46 positioned in the nip site simultaneously with the gripper in order to prevent damage to the equipment.

Additionally, the circumferential measurement of pressure roller 30 must be an inverse multiple of the circumferential measurement of press cylinder 16. By way of illustration, if pressure roller 30 has a circumferential measurement equivalent to the circumferential measurement of press cylinder 16, pressure roller 30 would require a number of recessed areas on its surface equal to the number of grippers on press cylinder 16. Furthermore, each of the recessed areas must be of sufficient depth to accommodate that portion of each gripper finger which extends from the body of each gripper and protrudes above the press cylinder surface.

Such a situation would be impossible however, due to the presence of press cylinders 18 and 20, which severely limit accessibility to the surface of press cylinder 16. Consequently, the circumferential measurement of pressure roller 30 cannot be equivalent to the circumferential measurement of press cylinder 16, but rather must be sufficiently reduced in order to access the cylinder surface.

Since pressure roller 30 will have a smaller circumferential measurement than press cylinder 16, it will rotate a number of times for every single rotation of press cylinder 16 in order to maintain the same surface speed. If press cylinder 16 has grippers present on its surface, pressure roller 30 will have to have a circumferential measurement which is an inverse multiple of the circumferential measurement of press cylinder 16 in order to have recessed area 46 present at nip site 24 when a gripper passes through the nip.

In a typical coating apparatus used in conjunction with a sheet-fed printing press, an applicator roller on the coater transfers the coating fluid to the printing press. In particular, the applicator roller either transfers the coating fluid directly to the workpiece as it moves through the nip site created between a printing press cylinder and the coating apparatus applicator roller or the applicator roller transfers the coating fluid to a blanket cylinder which, in turn, applies the coating fluid to the workpiece.

In either situation, the applicator roller will repeatedly apply coating fluid directly or indirectly to individual worksheets as they pass through the nip. Consequently, the applicator roller must have a circumferential measurement at least equivalent to sheet length in order to ensure image repeatability. Furthermore, the circumferential measurement of the applicator roller must actually be greater than the individual sheet length so that the "dead space" present on the press cylinder surface between the trailing edge of one sheet and the leading edge of the next sheet does not receive any coating fluid.

Due to the spacial constraints present in many printing press arrangements, a coating apparatus having an applicator roller conforming to even these minimal circumferential measurement parameters has a diameter which precludes it from abutting the desired press cylinder within the printing press in order to deliver a liquid coating fluid to a workpiece traveling thereon.

Consequently, in the preferred embodiment of the present invention, the coating plate belt 28 should be of sufficient length to accommodate a coating surface equivalent to the individual sheet length of workpiece 26 plus any additional length needed to provide for a "no print" region corresponding to the "dead space" on the press cylinder.

In short, the length of coating plate belt 28 should be proportional to the circumferential measurement of press cylinder 16. As previously mentioned, these considerations apply when the present invention is being

used in conjunction with a sheet-fed press or in a spot coating procedure done on either a sheet-fed or web-fed press. For spot coating procedures performed on a web-fed press, the belt length must be sized so as to incorporate "no print" regions despite the fact that no grippers or cylinder gaps are present. In contrast, overall coating procedures performed on a web-fed press do not require that the length of the coating plate belt be sized to account for the presence of "no print" regions since the coating fluid is continuously being applied.

The diameter of pressure roller 30 should be sufficiently reduced so as to afford clearance between press cylinders 18 and 20 while providing for contact of the coating belt with press cylinder 16. As previously mentioned, the circumferential measurement of pressure roller 30 should be an inverse multiple of the circumferential measurement of press cylinder 16 in order to ensure that the recessed area 46 is always present at the nip site whenever a gripper on press cylinder 16 passes through the nip.

In the preferred embodiment of the present invention, pressure roller 30 has, for example, a circumferential measurement which is ¼ the circumferential measurement of press cylinder 16. Consequently, for every complete rotation of press cylinder 16, pressure roller 30 makes four complete revolutions. Furthermore, recessed area 46 passes through nip site 24 four times, twice for every passage of a gripper through the nip. As a result, recessed area 46 only accommodates a gripper at nip site 24 during every other passage through the nip.

For example, referring to FIGS. 2 and 3, recessed area 46 is shown in a position just prior to entering nip site 24. Referring in particular to FIG. 2, grippers 48 and 50 are shown in their respective positions approximately 90° away from the nip site.

As previously explained, coating plate belt 28 must be of a length proportional to the circumferential measurement of press cylinder 16 and pressure roller 30 must be an inverse multiple of the circumferential measurement of press cylinder 16. Consequently, the length of coating plate belt 28 will be proportional to the circumferential measurement of pressure roller 30, by necessity.

This relationship is important. During every other passage of recessed area 46 through nip site 24, coating plate belt 28 is applying coating fluid to workpiece 26, as seen in FIG. 3. In order for the coating fluid to be uniformly applied to the surface of the workpiece, pressure roller 30 must apply sufficient back pressure to coating belt 28 at nip site 24.

In order to maintain this back pressure on the coating belt at the nip site during every other passage of recessed area 46 through the nip, a filler piece or strip 58 is mounted across the width of the coating belt as seen in FIG. 4. The filler piece is mounted on the backside of the coating belt which contacts rollers 30 and 32. Filler piece 58 should have dimensions approximating the dimensions of recessed area 46 so as to cooperatively mate with the recess. Similarly, recessed area 46 should have dimensions which can accommodate filler piece 58.

As previously explained with respect to the preferred embodiment of the present invention, press cylinder 16 makes one complete revolution for every four complete revolutions of pressure roller 30. Furthermore, recessed area 46 will pass through the nip site four times for every complete revolution of press cylinder 16. In two of these passes through the nip site, a gripper on press cylinder 16 will be present at the nip to meet the recessed area. In the other two passes through the nip site, no gripper will be present to meet the recessed area, however, the filler piece on the backside of the coating belt will move into recessed area to provide back pressure for the coating belt which is simultaneously delivering coating fluid to the workpiece in the nip.

Since the filler piece 58 is affixed to the backside of coating plate belt 28, its presence must be accommodated on transfer roller 32 as well. Consequently, transfer roller 32 has a secondary recessed area 60 on its surface. Secondary recessed area 60 also has dimensions which approximate the dimensions of filler piece 58 so as to accommodate the presence of the filler piece when it contacts the roller surface.

Referring to FIG. 4, coating plate belt 28 is shown in a plan view from the backside of the belt. The coating plate belt includes splicing patterns 62 and 64 which consists of cooperating mechanical segments which can interlock with one another in order to position the belt about rollers 30 and 32. The coating plate belt includes printing region 66 and no print region 68. Printing region 66 is available for delivering coating fluid to a workpiece as it passes through the nip site. Accordingly, coating plate belt 28 must be oriented about rollers 30 and 32 in such a fashion as to coordinate the passage of printing region 66 through the nip site with those areas on the surface of press cylinder 16 which do not constitute "dead space". No print region 68 includes gripper slots 56. This region of coating plate belt 28 must similarly be coordinated with the surface of press cylinder 16, however, it should be coordinated so as to pass through the nip site simultaneously with the "dead space" (not shown) present on press cylinder 16.

The coating plate belt of the present invention is interchangeable with other coating belts depending upon the coating operation to be performed. In overall coating operations where the workpiece receives full coverage of the coating fluid, the coating plate belt need only be changed depending upon the dimensions of the workpiece to be covered or the type of coating fluid to be applied. In spot coating operations, however, the coating plate belt should obviously be changed in accordance with designated areas on the workpiece which are to receive the coating fluid.

In operation, anilox roller 36 picks up coating fluid from coating fountain 34. Doctor blades 38 and 40 meter the supply of coating fluid on the anilox roller before the fluid is transferred to coating plate belt 28. Anilox roller 36 subsequently transfers the metered supply of coating fluid to coating plate belt 28 which is driven about rollers 30 and 32. Referring to FIG. 1, a workpiece 26 is shown partially positioned on press cylinder 16 with its leading edge held by gripper 48. Recessed area 46 is present to accommodate gripper 48 and the no print region 68 (not shown) of the belt is present in nip site 24 to correspond with the presence of "dead space" (not shown) on press cylinder 16. Filler piece 58 is shown positioned in contact with transfer roller 32 and residing in secondary recessed area 60.

As the workpiece moves through the nip, printing region 66 (not shown) of plate coating belt 28 applies the coating fluid to workpiece 26 at the nip site. Referring to FIG. 3, workpiece 26 is shown positioned well into the nip. Additionally, recessed area 46 on pressure roller 30 is about to enter the nip site 24. Filler piece 58 is shown residing in recessed area 46 in order to provide sufficient back pressure for coating plate belt 28 which

is applying coating fluid (not shown) to the workpiece. Secondary recessed area **60** on transfer cylinder **32** is shown vacant as filler piece **58** is residing in recessed area **46**.

While there have been described what are presently believed to be the preferred embodiments of the invention disclosed herein, those skilled in the art will realize that changes and modifications may be made thereto without departing from spirit of the invention, and it is intended to claim all such changes and modifications as fall within the true scope of the invention.

What is claimed is:

1. A liquid coating apparatus capable of operating in conjunction with a printing press having at least one press cylinder, the cylinder rotatably mounted within the press and having at least one gripper mechanism, the apparatus capable of applying a liquid coating fluid to a workpiece traveling over the press cylinder and comprising:

a driveable support means suitable for supporting a belt, the support means including a first and a second roller both rotatably mounted within the apparatus, at least one of the rollers being drivingly coupled to a drive means;

an endless coating plate belt for transferring the liquid coating fluid from the coating apparatus to the workpiece, the endless coating plate being trained about the first and second rollers and driveable by the rollers and supported thereon, the belt including at least three openings distributed transversely across the width of the belt;

drive means for driving the support means, thereby causing the endless coating plate belt to be driven about the first and second rollers;

supply means for supplying the liquid coating fluid to the endless coating plate belt; and

metering means for metering the supply of liquid coating fluid supplied to the endless coating plate belt.

2. The liquid coating apparatus according to claim **1**, wherein the first roller includes at least one recessed area present on the surface of the first roller and wherein the at least three openings are gripper slots formed through the thickness of the endless coating plate belt, the gripper slots being positionally aligned over the recessed area on the surface of the first roller at a selected angular rotational position of the first roller.

3. The liquid coating apparatus according to claim **2**, wherein the endless coating plate belt includes a filler piece having dimensions approximating the dimensions of the recessed area on the surface of the first roller, the filler piece being oriented on the endless coating plate belt so as to afford a cooperative communication of the filler piece with the recessed area on the surface of the first roller upon contact of the filler piece with the first roller and wherein the second roller includes a recessed area on its surface having suitable dimensions for accommodation of the filler piece in a cooperative relationship upon contact of the filler piece with the second roller.

4. The liquid coating apparatus according to claim **2**, wherein the first roller has a circumferential measurement which is an inverse multiple of the circumferential measurement of the press cylinder.

5. The liquid coating apparatus according to claim **4**, wherein the first roller has a circumferential measurement which is one-fourth the circumferential of the press cylinder.

6. The liquid coating apparatus according to claim **1**, wherein the endless coating plate belt has a length equivalent to the circumferential measurement of the press cylinder.

7. The liquid coating apparatus according to claim **1**, wherein the endless coating plate belt has a length which is an inverse multiple of the circumferential measurement of the press cylinder.

8. The liquid coating apparatus according to claim **7**, wherein the endless coating plate belt has a length which is one-half the circumferential measurement of the press cylinder.

9. An assembly including a printing press, a coating apparatus capable of operating in conjunction with the printing press and means for moving the coating apparatus into an adjoining relationship with the press so as to form a nip site through which workpieces can travel, the printing press having at least one press cylinder rotatably mounted within the press, the coating apparatus being capable of applying a liquid coating fluid to a workpiece traveling over the press cylinder, the coating apparatus comprising:

a driveable support means suitable for supporting a belt, the support means including a first and a second roller both rotatably mounted within the apparatus, at least one of the rollers being drivingly coupled to a drive means;

an endless coating plate belt for transferring the liquid coating fluid from the coating apparatus to the workpiece at the nip site, the endless coating plate belt being trained about the first and second rollers and driveable by the rollers and supported thereon, the belt including at least one opening formed therein, the opening configured and dimensioned to accommodate passage of the gripper mechanism therethrough;

drive means for driving the support means, thereby causing the endless coating plate belt to be driven about the first and second rollers;

supply means for supplying the liquid coating fluid to the endless coating plate belt; and

metering means for metering the supply of liquid coating fluid supplied to the endless coating plate belt.

10. The assembly according to claim **9**, wherein the first roller includes at least one recessed area present on the surface of the first roller and wherein the at least one opening is a gripper slot formed through the thickness of the endless coating plate belt, the gripper slot being positionally aligned over the recessed area on the surface of the first roller at a selected angular rotational position of the roller.

11. The assembly according to claim **10**, wherein the endless coating plate belt of the coating apparatus includes a filler piece having dimensions approximating the dimensions of the recessed area on the surface of the first roller, the filler piece being oriented on the endless coating plate belt so as to afford a cooperative communication of the filler piece with the recessed area on the surface of the first roller upon contact of the filler piece with the first roller and wherein the second roller includes a recessed area on its surface having suitable dimensions for accommodation of the filler piece in a cooperative relationship upon contact of the filler piece with the second roller.

12. The assembly according to claim **10**, wherein the first roller has a circumferentially measurement which

is an inverse multiple of the circumferential measurement of the press cylinder.

13. The assembly according to claim 12, wherein the first roller has a circumferential measurement which is one fourth the circumferential measurement of the press cylinder.

14. The assembly according to claim 9, wherein the endless coating plate belt of the coating apparatus has a length equivalent to the circumferential measurement of the press cylinder.

15. The assembly according to claim 9, wherein the endless coating plate belt of the coating apparatus has a length which is an inverse multiple of the circumferential measurement of the press cylinder.

16. The assembly according to claim 15, wherein the endless coating plate belt of the coating apparatus has a length which is one half the circumferential measurement of the press cylinder.

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US005476041A

United States Patent [19]

Czotscher

[11] **Patent Number:** 5,476,041

[45] **Date of Patent:** Dec. 19, 1995

[54] **PRINTING PRESS HAVING A DEVICE FOR CONTROLLING THE AIR IN A SHEET FEEDER**

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[21] Appl. No.: **288,471**

[22] Filed: **Aug. 10, 1994**

[30] **Foreign Application Priority Data**

Aug. 11, 1993 [DE] Germany 43 26 927.3

[51] **Int. Cl.**^{6} **B41F 13/24**

[52] **U.S. Cl.** **101/232**; 271/97; 271/98

[58] **Field of Search** 101/232, 248, 101/216; 271/227, 236, 250, 11, 96, 97, 98, 20

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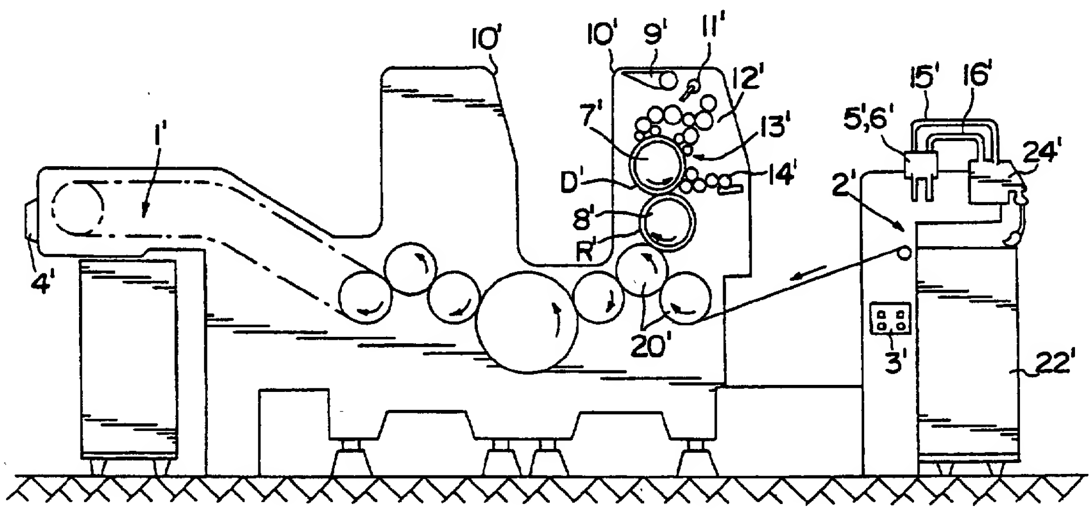
Primary Examiner—Eugene H. Eickholt

Attorney, Agent, or Firm—Nils H. Ljungman & Associates

[57] **ABSTRACT**

A printing press for printing an image on sheets of printing stock can generally have a sheet feeder for separating and at least initiating start of transport of the separated sheet into the printing press. Such a sheet feeder can have a device for controlling feeder blowing air and feeder suction air, wherein the control device can have respective valves for accurately controlling the amount of blowing air and suction air. In addition, the amount of blowing air can be essentially exactly adjustable via the control console of the machine.

20 Claims, 4 Drawing Sheets



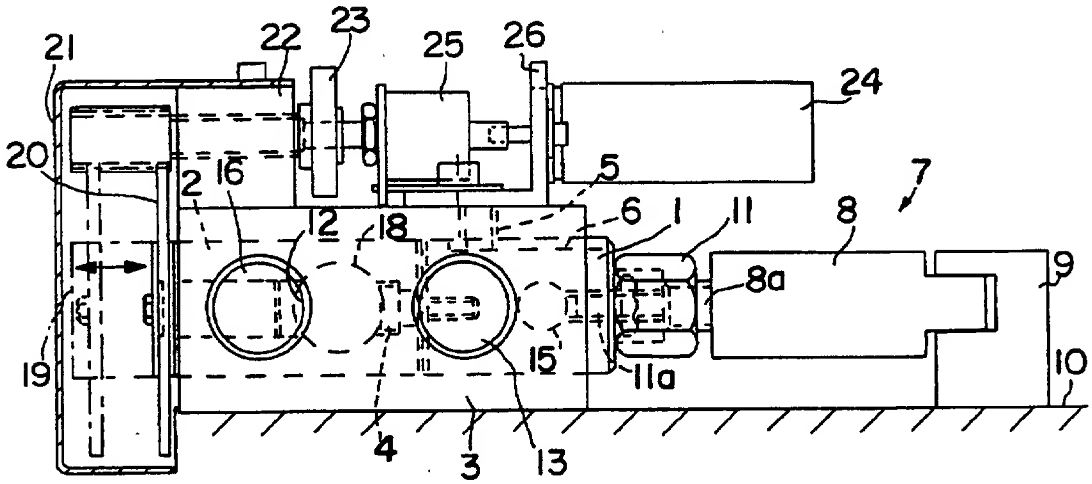

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FIG. 1

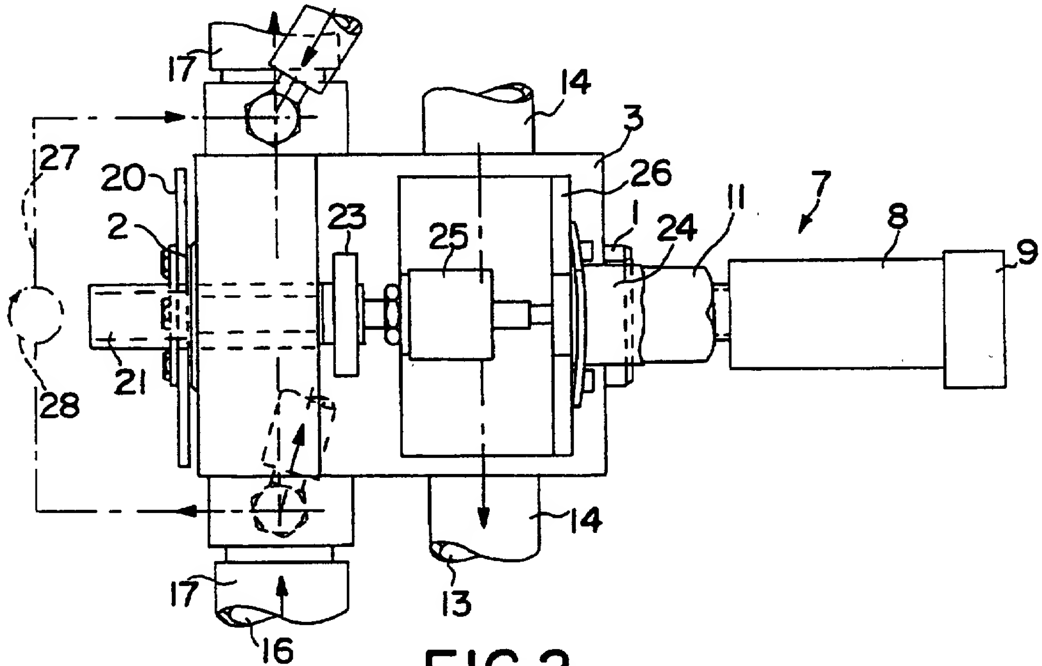
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FIG. 2

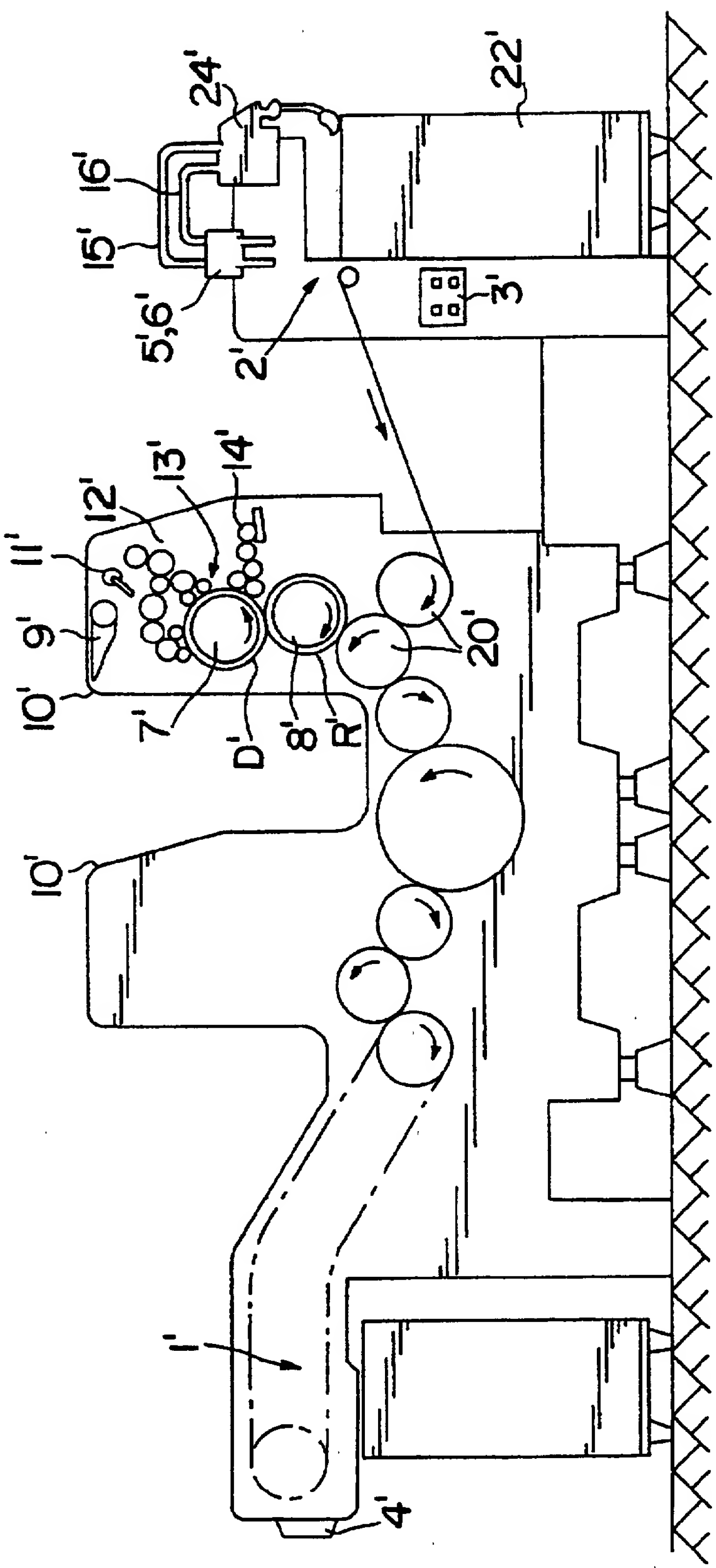

FIG.1a

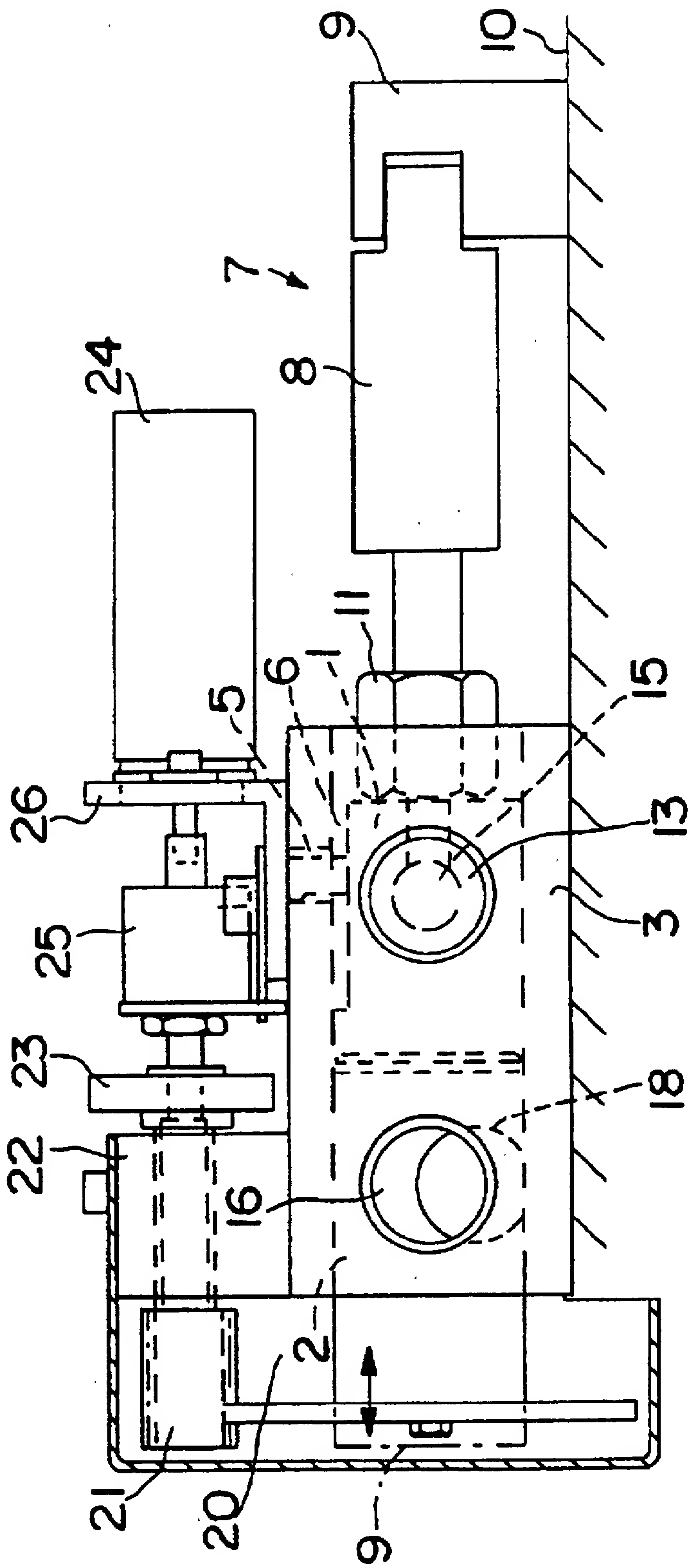

FIG.3

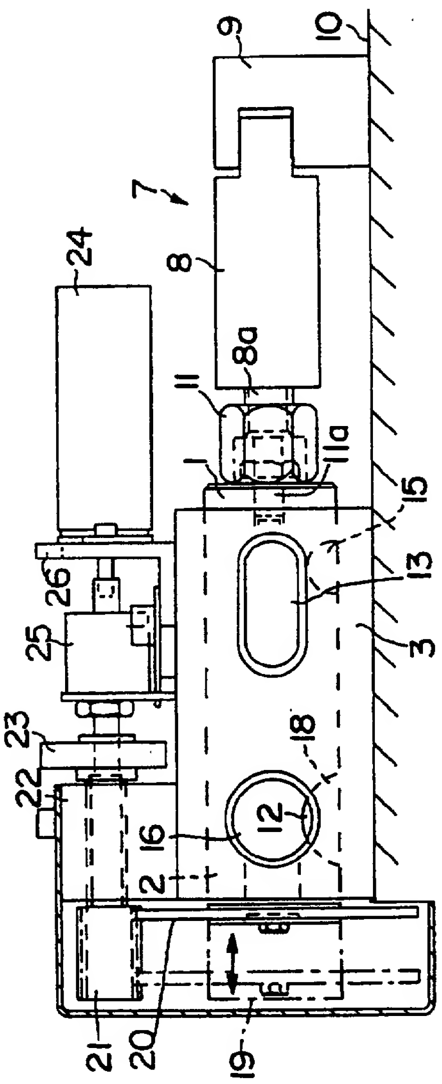

FIG.4

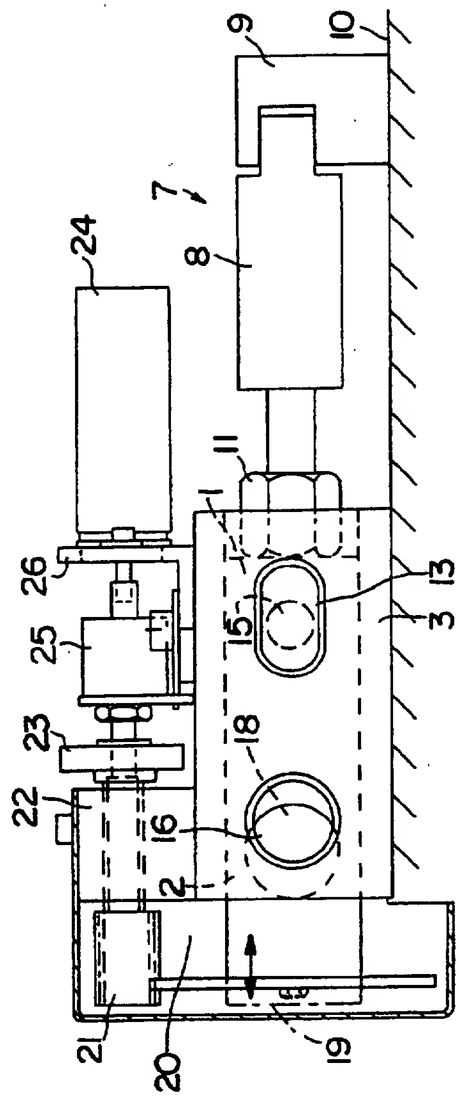

FIG.5

PRINTING PRESS HAVING A DEVICE FOR CONTROLLING THE AIR IN A SHEET FEEDER

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention generally relates to a printing machine, or press having a sheet feeder, and more specifically, to a device for controlling feeder blowing air and feeder suction air in a sheet feeder of a printing machine, or press. In general, printing presses are configured to handle large quantities of sheets of printing stock supplied in the form of a stack. For this purpose, sheet feeders which utilize air currents have been developed for repeatedly separating single sheets from a stack of sheets and initiating transport of the separated single sheets into the printing press. Such sheet feeders can utilize a blowing jet of air to fan the uppermost sheets of the stack, while a suction device can be provided to then suck the uppermost sheet thereto, and also to initiate movement of the sheet attached thereto into the printing press. The air suction and supply are generally controlled by a control device, which control device generally comprises respective valves for each of the feeder and blower air.

2. Background Information

A known embodiment of such a device is disclosed by German Laid Open Patent Application No. 39 31 995 A1, which corresponds to U.S. Pat. No. 5,068,876. This known embodiment provides two separate rotary valves for controlling the air, and each valve is individually controlled via an electromagnet. With this embodiment the rotary travel of an individual valve body may be manually adjusted via a rotary-travel limiter. Furthermore, fanning air supplied to the sheet feeder can also be manually adjusted via an adjusting screw so that the pressman does not have any exact adjusting values at hand, or in other words, so that the pressman does not have to remember the adjustment values that are input through the control.

OBJECT OF THE INVENTION

Proceeding from this known device, it is the object of the present invention to provide an air-controlling device for a sheet feeder of a printing press, which air-controlling device can preferably accurately control both blowing air and suction air, and by means of which air-controlling device, the blowing-air amount may be adjusted via the control console of the printing press.

SUMMARY OF THE INVENTION

According to the present invention this object can essentially be achieved by preferably providing both a first valve body for controlling the suction air and a second valve body for controlling the blowing air in a housing so as to be axially aligned. The two valve bodies are also preferably connected to each other in a manner so as to be axially firm, or moveable essentially simultaneously in an axial direction, while still being mutually turnable with respect to one another. One manner in which such a connection can be provided can preferably be by means of a fitting bolt. Further, an adjusting means can preferably be provided for axially adjusting both valve bodies to switch the suction air and the blowing air on and off. This adjusting means can preferably act on one of the two valve bodies, and there can preferably be provided a further drive device, which, via a

pair of gears, can turn a valve body in order to control the blowing-air amount.

Such a solution essentially permits very short control periods, while enabling one adjusting means to control the suction air and the blowing air, respectively. Moreover, via the control console, the pressman may then also be able to accurately adjust the blowing-air amount for the respective sheet material which is being processed, while the blowing-air adjustment that is selected can also preferably be maintained when switching off end on the blowing air.

In an advantageous embodiment of the present invention, the valve bodies can also preferably be axially adjustable, with respect to the axial adjusting device, via an adjusting nut, to thereby allow for variations in-the size of a small opening through which the fanning air may escape when the valves are closed. Further, so that both valve bodies do not rotate when the blowing air is being adjusted, the valve body controlling the suction air can preferably be fixed against rotation by means of a pin.

A constructional modification of the above device can be provided by a device wherein the two valve bodies are firmly connected to each other, both axially and rotationally, while providing an adjusting means via which the two valve bodies can he turned in order to switch the suction air and the blowing air on and off, respectively. For this embodiment, there can preferably be provided a drive, via which the blowing-air amount can be controlled by axially displacing the valve bodies. According to this solution, given a similar setup of the valve bodies, essentially only the adjusting means is used to turn the valve bodies, and the drive serves to axially displace the valve bodies, and thus control the blowing-air amount. This exchange of adjusting means and drive means, in comparison with the first embodiment, also permits short control periods and an essentially exact adjustment of the amount off air required.

An advantageous embodiment of the two modifications described above, provides that as the adjusting means, there can preferably be provided a pneumatic cylinder for acting on the two valve bodies for controlling the suction air and the blowing air, respectively. In addition, the drive controlling the amount of blowing air can preferably be designed as a geared motor which, via a potentiometer, adjusts the second valve body. The use of a pneumatic cylinder permits very short control periods, and the use of a geared motor, in combination with a potentiometer for monitoring operation of the motor, ensures a very exact adjustment and allows for a display of the adjusted value at the control desk.

In summary, one aspect of the invention resides broadly in a printing press comprising: a frame; a plate cylinder rotatably mounted on the frame, the plate cylinder for positioning a printing plate thereon; dampening apparatus for applying dampening medium to the printing plate; an ink reservoir for holding a supply of ink; an inking mechanism for transferring the ink between the ink reservoir and the plate cylinder at least during operation of the printing press; the inking mechanism comprising a plurality of inking rollers, at least one ink fountain roller, and at least one ink transfer roller for transferring ink between the ink fountain roller and at least one of the plurality of inking rollers; sheet feeding apparatus for feeding sheets of printing stock into the printing press from a stack of printing stock, the stack having a top for supplying sheets therefrom; a rubber blanket cylinder having a rubber blanket disposed thereabout for receiving an ink impression from the plate cylinder; a sheet drum for receiving sheets being fed for printing the ink impression of the rubber blanket onto the sheets;

sheet delivery apparatus for receiving printed sheets and stacking the printed sheets; the sheet feeding apparatus comprising: apparatus for providing input air to an area adjacent the stack of printing stock; apparatus for removal of exhaust air from an area adjacent the stack of printing stock; apparatus for controlling air flow through the apparatus for providing input air and the apparatus for removal of exhaust air; the apparatus for controlling comprising valve apparatus; the valve apparatus comprising: a first valve portion for controlling flow of air through the apparatus for providing input air, the first valve portion having at least an open configuration for passage of air therethrough and a closed configuration for blocking passage of air therethrough; a second valve portion for controlling flow of air through the apparatus for removal of exhaust air, the second valve portion having at least an open configuration for passage of air therethrough and a closed configuration for blocking passage of air therethrough; at least one solid element connecting at least a portion of i the first valve portion to at least a portion of the second valve portion for substantially simultaneously moving both of the at least a portion of the first valve portion and the at least a portion of the second valve portion between at least the open configuration and the closed configuration; and single operating apparatus for operating all of the at least a portion of the first valve portion, the at least a portion of the second valve portion and the at least one solid element substantially simultaneously.

Another aspect of the invention resides broadly in a device for controlling air flow in a sheet feeder in a printing press, the sheet feeder having apparatus for providing input air thereinto and apparatus for removal of exhaust air therefrom, the device for controlling comprising: valve apparatus for controlling air flow through the apparatus for providing input air and the apparatus for removal of exhaust air; the valve apparatus comprising: a first valve portion for controlling flow of air through the apparatus for providing input air, the first valve portion having at least an open configuration for passage of air therethrough and a closed configuration for blocking passage of air therethrough; a second valve portion for controlling flow of air through the apparatus for removal of exhaust air, the second valve portion having at least an open configuration for passage of air therethrough and a closed configuration for blocking passage of air therethrough; at least one solid element connecting at least a portion of the first valve portion to at least a portion of the second valve portion for substantially simultaneously moving both of the at least a portion of the first valve portion and the at least a portion of the second valve portion between at least the open configuration and the closed configuration; and single operating apparatus for operating all of the at least a portion of the first valve portion, the at least a portion of the second valve portion and the at least one solid element Substantially simultaneously.

BRIEF DESCRIPTION OF THE DRAWINGS

Specimen embodiments of a control device in accordance with the present invention are schematically illustrated in the accompanying drawings, in which:

FIG. 1*a* shows a side view of a printing press incorporating a device for controlling feeder blowing and suction air in accordance with the present invention;

FIG. 1 shows a side elevational view of a first embodiment of an air-controlling device in an off position;

FIG. 2 shows a plan view of the device shown in FIG. 1;

FIG. 3 shows a side elevational view of the valve of FIG. 1, but in en on position;

FIG. 4 shows a side elevational view of a second embodiment of an air-controlling device in an off position; and

FIG. 5 shows a side elevational view of the valve of FIG. 4, but in an on position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1*a* depicts a printing machine, or printing press, having a number of rotary printing stands **10'**, with a sheet delivery **1'** and a sheet feeder **2'**, which sheet feeder **2'** can employ an air control device **5'**, **6'** in accordance with the present invention, and described in further detail herebelow. In addition, a rotary print stand **10'** can also generally include: an ink supply source **9'** for containing a supply of ink, a plate cylinder **7'** for having mounted thereon a printing plate D'; an inking unit **12'** which includes ink applicator rollers **13'** for applying ink to the printing press; a vibrator roller **11'** for receiving ink from the ink supply **9'** and transferring the ink to the inking unit **12'**, a damping, or wetting unit **14'** for transferring a damping agent to the printing plate D'; a blanket cylinder **8'** carrying a rubber blanket R' for receiving an ink impression from the plate cylinder **7'**, and sheet drums **20'** for carrying a sheet of printing stock to the rubber blanket cylinder **8'** for transfer of the ink from the rubber blanket cylinder **8'** to the sheet of printing stock. Such a printing press can also have other accessory units, such as washing units, drive units, etc. which are well known and are not shown in the drawings.

The sheet feeder **2'** can preferably have a stack of sheets of printing stock **22'** and an air blower and suction device **5'**, **6'** **15'**, **16'** and **24'**, for lifting and transferring single sheets into the printing press. Such an air device can generally have two valve units **5'**, **6'** with one Valve unit corresponding to each of a suction air passage **15'** and a blower passage **16'**. The valves **5'** and **6'** can preferably be controlled from an operator control panel **3'**. Besides being operable via the operator controls **3'** at the sheet feeder **2'**, the sheet feeder **2'** may also be operated from a control console **4'** located at the delivery pile **1'**.

It should be understood that the components as discussed above with relation to FIG. 1*a*, may, if appropriate, essentially be considered to be interchangeable with similar components discussed herebelow with relation to FIGS. 1–5.

As depicted in FIGS. 1–3, a first valve body **1**, of a valve unit such as unit **5'**, **6'** as discussed previously in FIG. 1*a*, can preferably be provided in a housing **3** for controlling the suction air to a sheet feeder, and a second valve body **2** can preferably be provided for controlling the blowing air. In the depicted embodiment of FIG. 1, the valve bodies **1** and **2** are shown in an off position, and are arranged so as to be displaceable to the left to move the valve bodies **1** and **2** into a corresponding open position for flow of air therethrough. FIG. 3 depicts one possible configuration of the valve bodies **1** and **2** in a corresponding on position.

Both valve bodies **1**, **2** are preferably connected to each other in an axially firm and mutually turnable manner. One type of connection devise which could be used is a fitting bolt **4**, which enables the valve body **2**, controlling the blowing air, to be turned with respect to the valve body **1**, while also enabling both valve bodies to be displaced axially substantially simultaneously. In this embodiment, the valve body **1** can preferably be fixed against rotation in the housing **3** by means of a pin **5** engaging in a longitudinal groove **6** formed in the valve body **1**. Alternatively, a pin could extend from valve body **1** to engage a slot within the

housing 3. Further, other means of holding the valve body i stationary could also conceivably be used, such as a rigid connection, to an adjusting device 7.

In the specimen embodiment shown in FIG. 1 an adjusting device 7 acts on the first valve body 1, and therefore, in essence, acts on both bodies 1 and 2 because of the axial connection 4 therebetween. The adjusting device 7 can preferably be designed as a pneumatic cylinder 8 which, via a supporting bearing 9, can be attached to a wall 10 or any surface adjacent the valve device. Again, FIG. 1 shows the cylinder 8 retracted so that the valve bodies 1 and 2 are in an off, or substantially closed position. In this closed position, by means of an adjusting nut 11, the two valve bodies 1, 2 can be axially adjusted, if necessary, so that a small opening 12 can exist for the escape of fanning air. By means of such an adjustment, the size of the opening 12 can also preferably be adjusted very accurately for different paper thicknesses, etc. to allow more or less fanning air to escape therethrough. In at least one embodiment of the present invention, this adjusting nut 11 can preferably be axially fixed to a piston rod 8a, such that rotation thereof will draw a threaded rod 11a thereinto or push the threaded rod 11a away therefrom upon rotation of the nut 11, thereby axially displacing the valve bodies 1 and 2.

FIG. 1 shows the position in which the valve bodies 1, 2 are switched off so that the piston rod 8a of the pneumatic cylinder 8 is moved to the right into its end position. In so doing, an opening 13 of a suction-air line 14, can generally be closed as the suction-air opening 15, formed in the valve body 1, is displaced to the right and thus covered by the housing 3. The opening 16 of the blowing-air line 17 can preferably be offset with respect to the blowing-air opening 18 formed in the valve body 2 such that there remains a small opening 12 through which the fanning air may escape. The position in which the valves are open is the position in which both valve bodies 1, 2 are displaced to the left according to FIG. 1, as indicated by a dash-dotted line 19 in FIG. 1, and as is also depicted by FIG. 3.

In a sheet feeder device, it is generally desirable that the blowing and suction be provided by a single blower or fan unit, such as might be indicated as 24' in FIG. 1a. In other words, the air sucked out of the feeder is also the air blown back into the feeder. By providing such a valve unit wherein the blowing and suction air lines can be turned on and off substantially simultaneously using a single operational component, in accordance with the present invention, there would essentially be minimal concern about jamming of single independently operating valves for each of the blowing and suction lines, as have been used in known valve devices. Thus, both lines will either be open, or else both will be closed. On the other hand, in known devices using two separately operating valves, one valve may open when the other remains stuck shut, and there could then possibly be no suction air available while the blowing line is operating, or, alternatively, the air which is auctioned out may not be able to pass through a blocked blowing line.

In addition to the axial displacement provided by the adjusting device 7, as discussed above, an additional operating device can preferably be provided for rotating the valve body 2 with respect to the valve body 1. For this purpose, a spur gear 20 can preferably be provided for engaging in a broader spur gear 21, fastened to the front end of the valve body 2 for controlling the blowing air. The width of the spur gear 21 can preferably be designed such that the meshing of the gears is not interrupted over the axial displacement distance of the valve bodies 1, 2. The spur gear 21 can preferably be turnably mounted in a bearing body 22 and can be manually turned via a handwheel 23. Furthermore, there can also preferably be a geared motor 24 which controls the blowing-air amount and which, vie a potentiometer 25, can drive the spur gear 21. The geared motor 24 and the potentiometer 25 can preferably be fastened to the housing 3 via an angular-shaped body 26. By turning the valve body 2 via the geared motor 24 the alignment and covering of the blowing-air opening 18, and the opening 16 of the blowing-air line 17 may be varied such that a varying amount of blowing air may escape through the valve. This makes it possible to control the blowing air as a function of speed, for example, or to vary the blowing air according to the paper weight. FIG. 3 also essentially depicts an offset between the blowing air opening 18 and the opening 16, which was provided by relatively rotating the valve body 2 with respect to the valve body 1.

It should generally be understood that other types of drive systems could also possibly be used for relatively rotating the valve bodies. Such systems might include a transmission unit, such as a chain drive, or belt drive, and could even include a motor directly mounted to the end of the valve body 2, which motor could also be mounted to a holding device to be non-rotational with respect to the valve body 2. Substitution of any of the drive devices, and adjustment devices as discussed above would typically be well within the skill of the artisan, as a wide variety of drive devices are generally well known.

An alternative variant on the above embodiment of the present invention could preferably utilize, as an adjusting device 7, an electromagnet instead of a pneumatic cylinder 8. Such an electromagnet can preferably be configured to axially displace the valve bodies 1, 2, and the configuration and operation of such an electromagnet are generally well known and therefore not discussed in any further detail herein.

The set task may also be accomplished through another inventive construction of the valve, such as could be represented by the embodiment shown in FIGS. 4 and 5. With this specimen embodiment, the blowing air can preferably be switched on and off by turning the valve bodies 1 and 2 instead of axially displacing the valve bodies 1 and 2 as was discussed hereabove. In addition, the blowing air can then preferably be regulated by axially displacing the valve bodies 1 and 2 via an axial displacement device 7, such as, a motor-driven threaded spindle, or possibly even the pneumatic cylinder as discussed above. In this manner, an adjustable opening between blowing air opening 18 and opening 16 could still be achieved.

According to this alternative embodiment, the axial position of the valve bodies 1 and 2 can preferably remain unchanged when switching on and off the blowing air. This can essentially be accomplished by simply radially turning the valve bodies 1 and 2 so that the corresponding openings are no longer essentially aligned. In the position in which the blowing air is switched off, a small opening 12, for providing fanning air for fanning the sheets, can still be achieved in that the radial adjustment can provide such an opening. With this design the blowing-air valve may be actuated together with the suction-air valve, provided the valve bodies 1, 2 are firmly connected to each other. Alternatively, as shown in FIGS. 4 and 5, the valve bodies 1 and 2 could preferably be formed of a single body piece having two openings, or passages disposed substantially diametrically therethrough.

However, the ability for the suction opening 15 to remain unchanged when regulating the blowing air, that is, after

radially adjusting the suction opening to the on position, still has to essentially be guaranteed when an axial adjustment of the blowing air is performed. For this purpose the suction-air opening **13**, formed in the housing **3**, can preferably be designed as an oblong hole, or slot, in the axial direction of the housing **3**, so that, in the switched-on position, the bore **15** provided in the valve body **1** is still aligned with the opening **13**. This oblong opening **13** should therefore preferably be of such a length that the suction-air opening remains open in view of any axial blowing-air adjustment.

As an alternative to providing a small opening **12**, as shown in FIGS. **1** and **4**, in an alternative embodiment of the present invention, it is also conceivable to supply the fanning blowing air through a bypass **27** (indicated by a broken line in FIG. 2), whereby the bypass may comprise a valve **28** for adjusting the amount of air which is able to pass therethrough.

One feature of the invention resides broadly in a device for controlling feeder air and feeder suction air in a sheet feeder of a printing machine comprising respective valves, characterized in that a first valve body **1** for controlling suction air and a second valve body **2** for controlling blowing air are disposed in a housing so as to be axially aligned, that the two valve bodies **1**, **2** are connected to each other by a fitting bolt **4** in an axially firm and mutually turnable manner, that an adjusting means **7**, via which the two valve bodies are axially adjustable for switching on/off the suction air and blowing air, respectively, acts on a valve body **1**, and that there is provided a drive **24** which, via a pair of gearwheels **20**, **21**, turns the valve body **2** for controlling the amount of blowing air.

Another feature of the invention resides broadly in the device characterized in that, via an adjusting nut **11**, the valve bodies **1**, **2** are axially adjustable in order to vary the small opening **12** for the fanning blowing air, and that the valve body **1** controlling the suction air is fixed against rotation by means of a pin **5**.

Yet another feature of the invention resides broadly in the device characterized in that the two valve bodies **1**, **2** are firmly connected to each other, that there is provided an adjusting means **7** via which the two valve bodies **1**, **2** are turnable in order to switch on/off the suction air and the blowing air, respectively, and that there is provided a drive **24** controlling the amount of blowing air by axially displacing the valve bodies **1**, **2**.

Still another feature of the invention resides broadly in the device characterized in that as an adjusting means **7** there is provided a pneumatic cylinder **8** acting on the two valve bodies **1**, **2** for controlling the blowing air and the suction air, respectively, and that the drive controlling the amount of blowing air is designed as a geared motor **24** which, via a potentiometer **25**, adjusts the second valve body **2**.

Some examples of drive devices and potentiometers which could be used in conjunction with the present invention are disclosed by the following U.S. Pat. No. 5,215,014 to Burger and Mamberer, entitled "Positioning System for Rotary Folding Jaw Cylinder Adjustment Elements in a Rotary Printing Machine"; U.S. Pat. No. 5,034,004 to Crankshaw, entitled "Infusion Pump and Drive Systems Therefor"; U.S. Pat. No. 4,932,831 to White et al., entitled "All Terain Mobile Robot"; U.S. Pat. No. 4,931,041 to Feeset, entitled "Infusion Syringe Pump"; and U.S. Pat. No. 4,931,710 to DeVara and Kenny, entitled "Servoactuator with Feedback and Method of Calibrating".

Some example of pneumatic cylinders which could be used in conjunction with the present invention are disclosed by the following U.S. Pat. No. 4,573,369 to Horn, entitled "Linear Drive"; and U.S. Pat. No. 4,414,882 to Frei, entitled "Pneumatic Drive for Switching Elements and Control Elements".

Some examples of printing presses with sheet feeders that operate with blowing and suction air, in which the present invention could be used, and/or which provide additional components and features of printing presses and sheet feeders which could be used in conjunction with the present invention, are provided by the following U.S. Pat. No. 5,290,023 to Seaski and Honkawe, entitled "Sheet Feeder for Sheet-Fed Press"; U.S. Pat. No. 5,184,813 to Schwitmky and Stiel, entitled "Separating Jet Blast Air Control Assembly"; U.S. Pat. No. 5,076,564 to Marass, entitled "Sheet Feeder"; U.S. Pat. No. 5,110,110 to Wirz and Bergmeier, entitled "Loosening Blowers for Sheet Feeders of Sheet-Fed Rotary Printing Presses"; U.S. Pat. No. 5,092,578 to Bergmeier and Zeltner, entitled "Sheet Feeder in a Sheet-Processing Machine"; and U.S. Pat. No. 4,702,469 to Jeschke and Pollich, entitled "Apparatus and Method for Aligning Sheets".

The appended drawings in their entirety, including all dimensions, proportions and/or shapes in at least one embodiment of the invention, are accurate and to scale and are hereby included by reference into this specification.

All, or substantially all, of the components and methods of the various embodiments may be used with at least one embodiment or all of the embodiments, if more than one embodiment is described herein.

All of the patents, patent applications and publications recited herein, and in the Declaration attached hereto, are hereby incorporated by reference as if set forth in their entirety herein.

The corresponding foreign patent publication applications, namely, Federal Republic of Germany Patent Application No. P 43 26 927.3, filed on Aug. 11, 1993, having inventor Ernst Czotscher, and DE-OS P 43 26 927.3 and DE-PS P 43 26 927.3, as well as their published equivalents, and other equivalents or corresponding applications, if any, in corresponding cases in the Federal Republic of Germany and elsewhere, and the references cited in any of the documents cited herein, are hereby incorporated by reference as if set forth in their entirety herein.

The details in the patents, patent applications and publications may be considered to be incorporable, at applicant's option, into the claims during prosecution as further limitations in the claims to patentably distinguish any amended claims from any applied prior art.

The invention as described hereinabove in the context of the preferred embodiments is not to be taken as limited to all of the provided details thereof, since modifications and variations thereof may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A printing press comprising:

a frame;

a plate cylinder rotatably mounted on said frame, said plate cylinder for positioning a printing plate thereon;

dampening means for applying dampening medium to said printing plate;

an ink reservoir for holding a supply of ink;

an inking mechanism for transferring the ink between said ink reservoir and said plate cylinder at least during operation of said printing press;

said inking mechanism comprising a plurality of inking

rollers, at least one ink fountain roller, and at least one ink transfer roller for transferring ink between said ink fountain roller and at least one of said plurality of inking rollers;

sheet feeding means for feeding sheets of printing stock into the printing press from a stack of printing stock, the stack having a top for supplying sheets therefrom;

a rubber blanket cylinder i having a rubber blanket disposed thereabout for receiving an ink impression from the plate cylinder;

a sheet drum for receiving sheets being fed for printing the ink impression of the rubber blanket onto the sheets;

sheet delivery apparatus for receiving printed sheets and stacking the printed sheets;

said sheet feeding means comprising:

means for providing input air to an area adjacent the stack of printing stock, said means for providing input air comprising a first air passage for conducting input air to the area adjacent the stack of printing stock;

means for removal of exhaust air from an area adjacent the stack of printing stock, said means for removal of exhaust air comprising a second air passage for conducting exhaust air away from the area adjacent the stack of printing stock;

said first air passage being separate from and isolated from said second air passage;

means for controlling air flow through said means for providing input air and said means for removal of exhaust air;

said means for controlling comprising valve means;

said valve means comprising:

a first valve portion for controlling flow of air through said first air passage, said first valve portion having at least an open configuration for passage of air therethrough and a closed configuration for blocking passage of air therethrough;

a second valve portion for controlling flow of air through said second air passage, said second valve portion having at least an open configuration for passage of air therethrough and a closed configuration for blocking passage of air therethrough;

at least one solid element connecting at least a portion of said first valve portion to at least a portion of said second valve portion, said at least a portion of said first valve portion and said at least a portion of said second valve portion being connected by said at least one solid element for substantially simultaneous movement of both of said at least a portion of said first valve portion and said at least a portion of said second valve portion from at least the closed configuration to the open configuration for substantially simultaneous providing of air to the area adjacent the stack and removing of air from the area adjacent the stack, and for substantially simultaneously moving both of said at least a portion of said first valve portion and said at least a portion of said second valve portion from at least the open configuration to the closed configuration to substantially simultaneously stop providing of air to the area adjacent the stack and removing of air from the area adjacent the stack; and

single operating means for operating all of: said at least a portion of said first valve portion, said at least a portion of said second valve portion, and said at least one solid element, substantially simultaneously.

2. The printing press according to claim 1, wherein said valve means comprises:

a valve housing, said valve housing having first and second openings for defining at least a portion of the first air passage of said means for providing input air, and third and fourth openings for defining a second air passage of said means for removal of exhaust air;

a valve body for being disposed in said valve housing, said valve body comprising a first connecting passage for connecting said first and second openings, and a second connecting passage for connecting said third and fourth openings;

said first valve portion comprises said first and second openings and said first connecting passage;

said second valve portion comprises said third and fourth openings and said second connecting passage;

said single operating means being for moving said valve body within said valve housing to:

move said first connecting passage into at least partial alignment with said first and second openings to at least partially open said first air passage, and to substantially simultaneously move said second connecting passage into at least partial alignment with said third and fourth openings to at least partially open said second air passage; and

move said first connecting passage substantially out of alignment with said first and second openings to at least substantially close said first air passage, and to substantially simultaneously move said second connecting passage substantially out of alignment with said third and fourth openings to at least substantially close said second air passage.

3. The printing press according to claim 2, wherein:

said valve housing has an;exterior and defines a longitudinal axis;

said valve housing comprises a bore along said longitudinal axis;

said first, second, third and fourth openings being disposed through said housing from said exterior to said bore;

said valve body comprises a cylindrical body for being movably disposed within said bore;

said first and second connecting passages respectively comprise first and second bores within said cylindrical body; and

said means for operating comprises means for moving said cylindrical body within said bore to at least partially open and at least substantially close said first and second air passages.

4. The printing press according to claim 3, wherein:

said means for operating comprises first means for operating, and said first means for operating comprises one of:

means for rotating said cylindrical body within said bore; and

means for axially displacing said cylindrical body along the longitudinal axis of said bore; and

said valve means additionally comprises means for varying an amount of air flowing through said first air passage substantially independently of the amount of air flowing through said second air passage.

5. The printing press according to claim 4, wherein:

said cylindrical body defines a longitudinal axis, and said cylindrical body comprises:

a first body portion comprising said first connecting passage;

a second body portion comprising said second connecting passage, said first body portion being axially disposed with respect to said second body portion along said longitudinal axis of said cylindrical body;

said at least one solid element comprises means for rotatably connecting said first body portion to said second body portion for relative rotational movement between said first body portion and said second body portion;

said first means for operating comprises means for axially displacing said cylindrical body within said bore;

said valve means further comprises means for inhibiting rotation of said second body portion; and

said means for varying an amount of air flowing through said first air passage substantially independently of air flowing through said second air passage comprises second means for operating, said second means for operating comprises means for rotating said first body portion relative to said second body portion to move said first connecting passage relative to said first and second openings to vary an opening amount of said first air passage.

6. The printing press according to claim 5, wherein:

said valve means further comprise means for axially positioning said cylindrical body with respect to said first means for operating to partially open said first air passage with said second air passage closed;

said first and second connecting passages are each disposed substantially diametrically through said cylindrical body;

said first and second openings are disposed substantially diametrically with respect to one another on said housing;

said third and fourth openings are disposed substantially diametrically with respect to one another on said housing;

said means for rotatably connecting comprises bolt means extending from one of said first body portion and said second body portion and a threaded opening on the other of said first body portion and said second body portion to receive said bolt means therein;

said means for inhibiting rotation comprises pin means extending from one of said housing and said second body portion and slot means in the other of said housing and said second body portion for receiving said pin means therein;

said first means for operating comprises a pneumatic cylinder; and

said second means for operating comprises a motor, said motor having a rotatable shaft, and said rotatable shaft additionally comprising a transmission for transmitting rotational movement to said first body portion.

7. The printing press according to claim 6, wherein:

said pneumatic cylinder comprises a piston rod extending therefrom, said pneumatic cylinder and said piston rod defining a longitudinal axis;

said longitudinal axis of said pneumatic cylinder being disposed in alignment with said longitudinal axis of said cylindrical body;

said piston rod having a first end disposed away from said pneumatic cylinder;

said second body portion comprises a threaded member extending therefrom towards said pneumatic cylinder;

said first end of said piston rod comprises a threaded nut for engaging said threaded member of said second body portion for moving said second body portion during moving of said pneumatic cylinder;

said means for axially positioning said cylindrical body with respect to said first means for operating comprises said threaded nut and said threaded member, whereby rotation of said threaded nut axially displaces said threaded member;

said second means for operating further comprises a potentiometer driven by said rotatable shaft of said motor for measuring rotational movement/of said motor;

said rotatable shaft further comprising a handwheel for manually turning said rotatable shaft;

said transmission comprising a first gear disposed on said rotatable shaft, and a second gear disposed on said first body portion and meshing with said first gear;

said second gear being non-rotatably connected to said first body portion for movement of said first body portion with movement of said second gear; and

said means for inputting air additionally comprises an air bypass for bypassing air around said valve means when said first air passage is closed; and

said air bypass comprises an additional valve means for adjusting an amount of air bypassing said valve means.

8. The printing press according to claim 4, wherein:

said cylindrical body defines a longitudinal axis, and said cylindrical body comprises:

a one-piece integral member comprising both said first connecting passage, and said second connecting passage, said at least one solid element comprises said one-piece integral member;

said first means for operating comprises means for rotating said cylindrical body within said bore; and

said means for varying an amount of air flowing through said first air passage substantially independently of air flowing through said second air passage comprises second means for operating, said second means for operating comprises means for axially displacing said cylindrical body to move said first connecting passage relative to said first and second openings to vary an opening amount of said first air passage.

9. The printing press according to claim 8, wherein:

said first and second connecting passages are each disposed substantially diametrically through said cylindrical body and said first and second connecting passages are disposed spaced apart axially along said cylindrical body;

said first and second openings are disposed substantially diametrically with respect to one another on said housing;

said third and fourth openings are disposed substantially diametrically with respect to one another on said housing;

said first means for operating comprises a motor, said motor having a rotatable shaft, and said rotatable shaft additionally comprising a transmission for transmitting rotational movement to said first body portion; and

said second means for operating comprises a pneumatic cylinder.

10. The printing press according to claim 9, wherein:

said third and fourth openings comprise oblong slots, the oblong slots having a longitudinal dimension, and the longitudinal dimension being disposed parallel to the

longitudinal axis of said housing, said oblong slots being configured for maintaining said second air passage substantially open during axial movement of said cylindrical body to adjust air flow through said first air passage;

said pneumatic cylinder comprises a piston rod extending therefrom, said pneumatic cylinder and said piston rod defining a longitudinal axis;

said longitudinal axis of said pneumatic cylinder being disposed in alignment with said longitudinal axis of said cylindrical body;

said piston rod having a first end disposed away from said pneumatic cylinder;

said first end of said piston rod comprises means for engaging said cylindrical body for moving said cylindrical body during moving of said pneumatic cylinder;

said first means for operating further comprises a potentiometer driven by said rotatable shaft of said motor for measuring rotational movement of said motor;

said printing press further comprises at least one remote control panel for operating said first and second means for operating and monitoring said potentiometer;

said rotatable shaft further comprising a handwheel for manually turning said rotatable shaft;

said transmission comprises a first gear disposed on said rotatable shaft, and a second gear disposed on said first body portion, said second gear meshing with said first gear;

said second gear being non-rotatably connected to said cylindrical body for moving said first body portion during moving of said second gear;

said means for inputting air additionally comprises an air bypass for bypassing air around said valve means when said first air passage is closed; and

said air bypass comprises an additional valve means for adjusting an amount of air bypassing said valve means.

11. In a printing press comprising:

a free, a plate cylinder rotatably mounted on said frame, said plate cylinder for positioning a printing plate thereon, dampening means for applying dampening medium to said printing plate, an ink reservoir for holding a supply of ink, an inking mechanism for transferring the ink between said ink reservoir and said plate cylinder at least during operation of said printing press, said inking mechanism comprising a plurality of inking rollers, at least one ink fountain roller, and at least one ink transfer roller for transferring ink between said ink fountain roller and at least one of said plurality of inking rollers, sheet feeding means for feeding sheets of printing stock into the printing press from a stack of printing stock, the stack having a top for supplying sheets therefrom, a rubber blanket cylinder having a rubber blanket disposed thereabout for receiving an ink impression from the plate cylinder, a sheet drum for receiving sheets being fed for printing the ink impression of the rubber blanket onto the sheets, and sheet delivery apparatus for receiving printed sheets and stacking the printed sheets;

means for controlling air flow of the sheet feeding means, the sheet feeding means having means for providing input air thereinto and means for removal of exhaust air therefrom, said means for controlling comprising:

valve means for controlling air flow through said means for providing input air and said means for removal of exhaust air;

said valve means comprising:

a first valve portion for controlling flow of air through said means for providing input air, said first valve portion having at least an open configuration for passage of air therethrough and a closed configuration for blocking passage of air therethrough;

a second valve portion for controlling flow of air through said means for removal of exhaust air, said second valve portion having at least an open configuration for passage of air therethrough and a closed configuration for passage of air therethrough;

at least one solid element connecting at least a portion of said first valve portion to at least a portion of said second valve portion for substantially simultaneously moving both of said at least a portion of said first valve portion and said at least a portion of said second valve portion between at least the open configuration and the closed configuration;

single operating means for operating all of said at least a portion of said first valve portion, said at least a portion of said second valve portion and said at least one solid element substantially simultaneously to substantially simultaneously open both said first and second valve portion and substantially simultaneously close said first and second valve portion; and

means for operating said first valve portion substantially independently of said second valve portion for varying an amount of air flowing through said first valve portion substantially independently of the amount of air flowing through said second valve portion.

12. The means for controlling according to claim 11, wherein said valve means comprises:

a valve housing having first and second openings for defining a first air passage of said means for providing input air, and third and fourth openings for defining a second air passage of said means for removal of exhaust air;

a valve body for being disposed in said valve housing, said valve body comprising a first connecting passage for connecting said first and second openings, and a second connecting passage for connecting said third and fourth openings;

said first valve portion comprises said first and second openings and said first connecting passage;

said second valve portion comprises said third and fourth openings and said second connecting passage;

said single operating means being for moving said valve body within said valve housing to:

move said first connecting passage into at least partial alignment with said first and second openings to at least partially open said first air passage, and to substantially simultaneously move said second connecting passage into at least partial alignment with said third and fourth openings to at least partially open said second air passage; and

move said first connecting passage substantially out of alignment with said first and second openings to at least substantially close said first air passage, and to substantially simultaneously move said second connecting passage substantially out of alignment with said third and fourth openings to at least substantially close said second air passage.

13. The means for controlling according to claim 12, wherein:

said valve housing has an exterior and defines a longitudinal axis;

said valve housing comprises a bore along said longitudinal axis;

said first, second, third and fourth openings being disposed through said housing from said exterior to said bore;

said valve body comprises a cylindrical body for being movably disposed within said bore;

said first and second connecting passages respectively comprise first and second bores within said cylindrical body; and

said means for operating comprises means for moving said cylindrical body within said bore to at least partially open and at least substantially close said first and second air passages.

14. The means for controlling according to claim 13, wherein:

said means for operating comprises first means for operating, and said first means for operating comprises one of:

means for rotating said cylindrical body within said bore; and

means for axially displacing said cylindrical body along the longitudinal axis of said bore.

15. The means for controlling according to claim 14, wherein:

said cylindrical body defines a longitudinal axis, and said cylindrical body comprises:

a first body portion comprising said first connecting passage;

a second body portion comprising said second connecting passage, said first body portion being axially disposed with respect to said second body portion along said longitudinal axis of said cylindrical body;

said at least one solid element comprises means for rotatably connecting said first body portion to said second body portion for relative rotational movement between said first body portion and said second body portion;

said first means for operating comprises means for axially displacing said cylindrical body within said bore;

said valve means further comprises means for inhibiting rotation of said second body portion; and

said means for operating said first valve portion substantially independently of said second valve portion for varying an amount of air flowing through said first air passage substantially independently of air flowing through said second air passage comprises second means for operating, said second means for operating comprises means for rotating said first body portion relative to said second body portion to move said first connecting passage relative to said first and second openings to vary an opening amount of said first air passage.

16. The means for controlling according to claim 15, wherein:

said valve means further comprise means for axially positioning said cylindrical body with respect to said first means for operating to partially open said first air passage with said second air passage closed;

said first and second connecting passages are each disposed substantially diametrically through said cylindrical body;

said first and second openings are disposed substantially diametrically with respect to one another on said housing;

said third and fourth openings are disposed substantially diametrically with respect to one another on said housing;

said means for rotatably connecting comprises bolt means extending from one of said first body portion and said second body portion end a threaded opening on the other of said first body portion and said second body portion to receive said bolt means therein;

said means for inhibiting rotation comprises pin means extending from one of said housing and said second body portion and slot means in the other of said housing and said second body portion for receiving said pin means therein;

said first means for, operating comprises a pneumatic cylinder; and

said second means for operating comprises a motor, said motor having a rotatable shaft, and said rotatable shaft additionally comprising a transmission for transmitting rotational movement to said first body portion.

17. The means for controlling according to claim 16, wherein:

said pneumatic cylinder comprises a piston rod extending therefrom, said pneumatic cylinder and said piston rod defining a longitudinal axis;

said longitudinal axis of said pneumatic cylinder being disposed in alignment with said longitudinal axis of said cylindrical body;

said piston rod having a first end disposed away from said pneumatic cylinder;

said second body portion comprises a threaded member extending therefrom towards said pneumatic cylinder;

said first end of said piston rod comprises a threaded nut for engaging said threaded member of said second body portion for moving said second body portion during moving of said pneumatic cylinder;

said means for axially positioning said cylindrical body with respect to said first means for operating comprises said threaded nut and said threaded member, whereby rotation of said threaded nut axially displaces said threaded member;

said second means for operating further comprises a potentiometer driven by said rotatable shaft of said motor for measuring rotational movement of said motor;

said rotatable shaft further comprising a handwheel for manually turning said rotatable shaft;

said transmission comprising a first gear disposed on said rotatable shaft, and a second gear disposed on said first body portion and meshing with said first gear;

said second gear being non-rotatably connected to said first body portion for movement of said first body portion with movement of said second gear; and

said means for inputting air additionally comprises an air bypass for bypassing air around said valve means when said first air passage is closed; and

said air bypass comprises an additional valve means for adjusting an amount of air bypassing said valve means.

18. The means for controlling according to claim 14, wherein:

said cylindrical body defines a longitudinal axis, and said cylindrical body comprises:

a one-piece integral member comprising both said first connecting passage, and said second connecting passage, said

at least one solid element comprises said one-piece integral member;

said first means for operating comprises means for rotating said cylindrical body within said bore; and

said means for operating said first valve portion substantially independently of said second valve portion for varying an amount of air flowing through said first air passage substantially independently of air flowing through said second air passage comprises second means for operating, said second means for operating comprises means for axially displacing said cylindrical body to move said first connecting passage relative to said first and second openings to vary an opening amount of said first air passage.

19. The means for controlling according to claim **18**, wherein:

said first and second connecting passages are each disposed substantially diametrically through said cylindrical body and said first and second connecting passages are disposed spaced apart axially along said cylindrical body;

said first and second openings are disposed substantially diametrically with respect to one another on said housing;

said third and fourth openings are disposed substantially diametrically with respect to one another on said housing;

said first means for operating comprises a motor, said motor having a rotatable shaft, and said rotatable shaft additionally comprising a transmission for transmitting rotational movement to said first body portion; and

said second means for operating comprises a pneumatic cylinder.

20. The means for controlling according to claim **19**, wherein:

said third and fourth openings comprise oblong slots, the

oblong slots having a longitudinal dimension, and the longitudinal dimension being disposed parallel to the longitudinal axis of said housing, said oblong slots being configured for maintaining said second air passage substantially open during axial movement of said cylindrical body to adjust air flow through said first air passage;

said pneumatic cylinder comprises a piston rod extending therefrom, said pneumatic cylinder and said piston rod defining a longitudinal axis;

said longitudinal axis of said pneumatic cylinder being disposed in alignment with said longitudinal axis of said cylindrical body;

said piston rod having a first end disposed away from said pneumatic cylinder;

said first end of said piston rod comprises means for engaging said cylindrical body for moving said cylindrical body during moving of said pneumatic cylinder;

said first means for operating further comprises a potentiometer driven by said rotatable shaft of said motor for measuring rotational movement of said motor;

said printing press further comprises et least one remote control panel for operating said first and second means for operating and monitoring said potentiometer;

said rotatable shaft further comprising a handwheel for manually turning said rotatable shaft;

said transmission comprises a first gear disposed on said rotatable shaft, and a second gear disposed on said first body portion, said second gear meshing with said first gear;

said second gear being non-rotatably connected to said cylindrical body for moving said first body portion during moving of said second gear;

said means for inputting air additionally comprises an air bypass for bypassing air around said valve means when said first air passage is closed; and

said air bypass comprises an additional valve means for adjusting an amount of air bypassing said valve means.

* * * * *

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(54) **Printing or coating unit for a rotary offset printing press**

(57) A retractable in-line inking/coating apparatus can apply either spot or overall inking/coating material to a plate and/or a blanket on the first printing unit or on any consecutive printing unit of any rotary offset printing press. The inking/coating apparatus is pivotally mounted within the conventional dampener space of any lithographic printing unit. The aqueous component of the flexographic printing ink or aqueous coating material is evaporated and dried by high velocity, hot air dryers and high performance heat and moisture extractors so that the aqueous or flexographic ink or coating material on a freshly printed or coated sheet is dry and can be dry-trapped on the next printing unit. The inking/coating apparatus includes dual cradles that support first and second applicator rollers (66,67) so that the inking/coating apparatus can apply a double bump of aqueous/flexographic or UV-curable printing ink or coating material to a plate on the plate cylinder (32), while simultaneously applying aqueous, flexographic or UV-curable printing ink or coating material to a plate or a blanket on the blanket cylinder (34), and thereafter onto a sheet as the sheet is transferred through the nip between the blanket cylinder (34), and the impression cylinder (36). A triple bump is printed or coated on the last printing unit with the aid of an impression cylinder inking/coating unit.

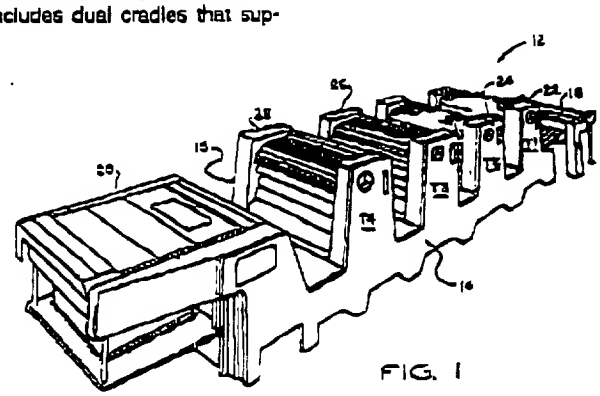

FIG. 1

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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	US 4 615 293 A (HEIDELBERGER DRUCKMASCHINEN AG) ---		B41F7/02 B41F23/04 B41F23/08 B41F5/22
D,A	US 5 107 790 A (RAPIDAC MACHINE CORP.) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 March 1998	Loncke, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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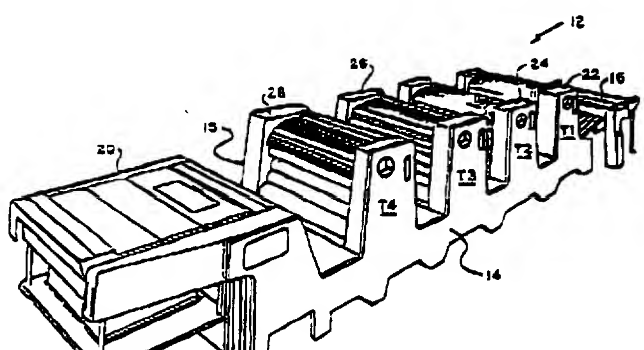

FIG. 1

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Description

Field of the Invention

This invention relates generally to sheet-fed or web-fed, rotary offset lithographic printing presses, and more particularly, to a new and improved inking/coating apparatus for the in-line application of aqueous or flexographic printing inks, primer or protective/decorative coatings applied simultaneously to the plate and blanket of the first or any consecutive printing unit of any lithographic printing press.

Background of the Invention

Conventional sheet-fed, rotary offset printing presses typically include one or more printing units through which individual sheets are fed and printed. After the last printing unit, freshly printed sheets are transferred by a delivery conveyor to the delivery end of the press where the freshly printed and/or coated sheets are collected and stacked uniformly. In a typical sheet-fed, rotary offset printing press such as the Heidelberg Speedmaster line of presses, the delivery conveyor includes a pair of endless chains carrying gripper bars with gripper fingers which grip and pull freshly printed sheets from the last impression cylinder and convey the sheets to the sheet delivery stacker.

Since the inks used with sheet fed rotary offset printing presses are typically wet and tacky, special precautions must be taken to prevent marking and smearing of the freshly printed or coated sheets as the sheets are transferred from one printing unit to another. The printed ink on the surface of the sheet dries relatively slowly and is easily smeared during subsequent transfer between printing units. Marking, smearing and smudging can be prevented by a vacuum assisted sheet transfer apparatus as described in the following U.S. Patents: 5,113,255; 5,127,329; 5,205,217; 5,228,391; 5,243,909; and 5,419,254, all to Howard W. DeMoore, co-inventor, and manufactured and sold by Printing Research, Inc. of Dallas, Texas, U.S.A. under its trademark BACVAC™.

In some printing jobs, offsetting is prevented by applying a protective and/or decorative coating material over all or a portion of the freshly printed sheets. Some coatings are formed of a UV-curable or water-dispersed resin applied as a liquid solution over the freshly printed sheets to protect the ink from offsetting or set-off and improve the appearance of the freshly printed sheets. Such coatings are particularly desirable when decorative or protective finishes are applied in the printing of posters, record jackets, brochures, magazines, folding cartons and the like.

Description of the Prior Art

Various arrangements have been made for applying the coating as an in-line printing operation by using the last printing unit of the press as the coating application unit. For example, U.S. Patents 4,270,483; 4,685,414; and 4,779,557 disclose coating apparatus which can be moved into position to permit the blanket cylinder of the last printing unit of a printing press to be used to apply a coating material over the freshly printed sheets. In U.S. Patent 4,841,903 (Bird) there are disclosed coating apparatus which can be selectively moved between the plate cylinder or the blanket cylinder of the last printing unit of the press so the last printing unit can only be used for coating purposes. However, when coating apparatus of these types are being used, the last printing unit cannot be used to print ink to the sheets, but rather can only be used for the coating operation. Thus, while coating with this type of in-line coating apparatus, the printing press loses the capability of printing on the last printing unit as it is converted to a coating unit.

The coater of U.S. Patent 5,107,790 (Sliker et al) is retractable along an inclined rail for extending and retracting a coater head into engagement with a blanket on the blanket cylinder. Because of its size, the rail-retractable coater can only be installed between the last printing unit of the press and the delivery sheet stacker, and cannot be used for interunit coating. The coater of U.S. Patent 4,615,293 (Jahn) provides two separate, independent coaters located on the dampener side of a converted printing unit for applying lacquer to a plate and to a rubber blanket. Consequently, although a plate and blanket are provided, the coating unit of Jahn's press is restricted to a dedicated coating operation only.

Proposals have been made for overcoming the loss of a printing unit when in-line coating is used, for example as set forth in U.S. Patent 5,176,077 to Howard W. DeMoore (co-inventor and assignee), which discloses a coating apparatus having an applicator roller positioned to apply the coating material to the freshly printed sheet while the sheet is still on the last impression cylinder of the press. This allows the last printing unit to print and coat simultaneously, so that no loss of printing unit capability results.

Some conventional coaters are rail-mounted and occupy a large amount of press space and reduce access to the press. Elaborate equipment is needed for retracting such coaters from the operative coating position to the inoperative position, which reduces access to the printing unit.

Accordingly, there is a need for an in-line inking/coating apparatus which does not result in the loss of a printing unit, does not extend the length of the press, and which can print and coat aqueous and flexographic inks and coating materials simultaneously onto the plate and blanket on any lithographic printing unit of any lithographic printing press, including the first printing unit.

Objects of the Invention

Accordingly, a general object of the present inven-

tion is to provide improved inking/coating apparatus which is capable of selectively applying ink or coating material to a plate on a plate cylinder or ink or coating material to a plate or blanket on a blanket cylinder.

A specific object of the present invention is to provide improved inking/coating apparatus of the character described which is extendable into inking/coating engagement with either a plate on a plate cylinder or to a plate or blanket on a blanket cylinder.

A related object of the present invention is to provide improved inking/coating apparatus of the character described which is capable of being mounted on any lithographic printing unit of the press and does not interfere with operator access to the plate cylinder, blanket cylinder, or adjacent printing units.

Another object of the present invention is to provide improved inking/coating apparatus of the character described, which can be moved from an operative inking/coating engagement position adjacent to a plate cylinder or a blanket cylinder to a non-operative, retracted position.

Still another object of the present invention is to provide improved inking/coating apparatus of the character described, which can be used for applying aqueous, flexographic and ultra-violet curable inks and/or coatings in combination with lithographic, flexographic and waterless printing processes on any rotary offset printing press.

A related object of the present invention is to provide improved inking/coating apparatus of the character described, which is capable of applying aqueous or flexographic ink or coating material on one printing unit, for example the first printing unit, and drying the ink or coating material before it is printed or coated on the next printing unit so that it can be overprinted or overcoated immediately on the next printing unit with waterless, aqueous, flexographic or lithographic inks or coating materials.

Yet another object of the present invention is to provide improved inking/coating apparatus for use on a multiple color rotary offset printing press that can apply ink or coating material separately and/or simultaneously to the plate and/or blanket of a printing unit of the press from a single operative position, and from a single inking/coating apparatus.

A related object of the present invention is to provide improved inking/coating apparatus of the character described, in which virtually no printing unit adjustment or alteration is required when the inking/coating apparatus is converted from plate to blanket printing or coating and vice versa.

Another object of the present invention is to provide improved inking/coating apparatus that can be operably mounted in the dampener space of any lithographic printing unit for inking/coating engagement with either a plate on a plate cylinder or a plate or blanket on a blanket cylinder, and which does not interfere with operator movement or activities in the interunit space between printing units.

Summary of the Invention

The foregoing objects are achieved by a retractable, inline inking/coating apparatus which is mounted on the dampener side of any printing unit of a rotary offset press for movement between an operative (on-impression) inking/coating position and a retracted, disengaged (off-impression) position. The inking/coating apparatus includes an applicator roller which is movable into and out of engagement with a plate on a plate cylinder or a blanket on a blanket cylinder. The inking/coating applicator head is pivotally coupled to a printing unit by pivot pins which are mounted on the press side frames in the traditional dampener space of the printing unit in parallel alignment with the plate cylinder and the blanket cylinder. This dampener space mounting arrangement allows the inking/coating unit to be installed between any adjacent printing units on the press.

In the preferred embodiment, the applicator head includes vertically spaced pairs of cradle members with one cradle pair being adapted for supporting an inking/coating applicator roller in alignment with a plate cylinder, and the other cradle pair supporting an inking/coating applicator roller in alignment with the blanket cylinder, respectively, when the applicator head is in the operative position. Because of the pivotal support provided by the pivot pins, the applicator head can be extended and retracted within the limited space available in the traditional dampener space, without restricting operator access to the printing unit cylinders and without causing a printing unit to lose its printing capability.

When the inking/coating apparatus is used in combination with a flexographic printing plate and aqueous or flexographic ink or coating material, the water component of the aqueous or flexographic ink or coating material on the freshly printed or coated sheet is evaporated and dried by a high velocity, hot air interunit dryer and a high volume heat and moisture extractor assembly so that the freshly printed ink or coating material is dry before the sheet is printed or coated on the next printing unit. This quick drying process permits a base layer or film of ink, for example opaque white or metallic (gold, silver or other metallics) ink to be printed on the first printing unit, and then overprinted on the next printing unit without back-trapping or dot gain.

The construction and operation of the present invention will be understood from the following detailed description taken in conjunction with the accompanying drawings which disclose, by way of example, the principles and advantages of the present invention.

Brief Description of the Drawings

FIGURE 1 is a perspective view of a sheet fed, rotary offset printing press having inking/coating apparatus embodying the present invention;

FIGURE 2 is a simplified perspective view of the

single head, dual cradle inking/coating apparatus of the present invention;

FIGURE 3 is a schematic side elevational view of the printing press of Figure 1 having single head, dual cradle inking/coating apparatus installed in the traditional dampener position of the first, second and last printing units;

FIGURE 4 is a simplified side elevational view showing the single head, dual cradle inking/coating apparatus in the operative inking/coating position for simultaneously printing on the printing plate and blanket on the fourth printing unit;

FIGURE 5 is a simplified side elevational view showing the single head, dual cradle inking/coating apparatus in the operative position for spot or overall inking or coating on the blanket of the first printing unit, and showing the dual cradle inking/coating apparatus in the operative position for spot or overall inking or coating on the printing plate of the second printing unit;

FIGURE 6 is a simplified side elevational view of the single head, dual cradle inking/coating apparatus of FIGURE 4 and FIGURE 5, partially broken away, showing the single head, dual cradle inking/coating apparatus in the operative coating position and having a sealed doctor blade reservoir assembly for spot or overall coating on the blanket;

FIGURE 7 is a schematic view showing a heat exchanger and pump assembly connected to the single head, dual cradle inking/coating apparatus for circulating temperature controlled ink or coating material to the inking/coating apparatus;

FIGURE 8 is a side elevational view, partially broken away, and similar to FIGURE 6 which illustrates an alternative coating head arrangement;

FIGURE 9 is a simplified elevational view of a printing unit which illustrates pivotal coupling of the inking/coating apparatus on the printing unit side frame members;

FIGURE 10 is a view similar to FIGURE 2 in which a pair of split applicator rollers are mounted in the upper cradle and lower cradle, respectively;

FIGURE 11 is a side elevational view of a split applicator roller;

FIGURE 12 is a perspective view of a doctor blade reservoir which is centrally partitioned by a seal element;

FIGURE 13 is a sectional view showing sealing engagement of the split applicator roller against the partition seal element of FIGURE 12;

FIGURE 14 is a view similar to FIGURE 8 which illustrates an alternative inking/coating embodiment;

FIGURE 15 is a simplified side elevational view of a substrate which has a bronzed-like finish which is applied by simultaneous operation of the dual applicator roller embodiment of FIGURE 14;

FIGURE 16 is a side elevational view, partly in section, of a pan roller having separate transfer surfaces mounted on a split fountain pan;

FIGURE 17 is a simplified side elevational view of the dual cradle inking/coating apparatus, partially broken away, which illustrates an alternative inking/coating head apparatus featuring a single doctor blade assembly, anilox applicator roller mounted on the lower cradle; and

FIGURE 18 is a side elevational view, partly in section, of a single doctor blade anilox applicator roller assembly having separate transfer surfaces, and a split fountain pan having separate fountain compartments, with the separate fountain compartments being supplied with different inks or coating materials from separate off-press sources.

Detailed Description of the Preferred Embodiments

As used herein, the term "processed" refers to printing and coating methods which can be applied to either side of a substrate, including the application of lithographic, waterless, UV-curable, aqueous and flexographic inks and/or coatings. The term "substrate" refers to sheet and web material. Also, as used herein, the term "waterless printing plate" refers to a printing plate having image areas and non-image areas which are oleophilic and oleophobic, respectively. "Waterless printing ink" refers to an oil-based ink which does not contain a significant aqueous component. "Flexographic plate" refers to a flexible printing plate having a relief surface which is wettable by flexographic ink or coating material. "Flexographic printing ink or coating material" refers to an ink or coating material having a base constituent of either water, solvent or UV-curable liquid. "UV-curable lithographic printing ink and coating material" refers to oil-based printing inks and coating materials that can be cured (dried) photomechanically by exposure to ultraviolet radiation, and that have a semi-paste or gel-like consistency. "Aqueous printing ink or coating material" refers to an ink or coating material that predominantly contains water as a solvent, diluent or vehicle. A "relief plate" refers to a printing plate having image areas which are raised relative to non-image areas which are recessed.

As shown in the exemplary drawings, the present invention is embodied in a new and improved in-line inking/coating apparatus, herein generally designated 10, for applying aqueous, flexographic or UV-curable inks or protective and/or decorative coatings to sheets or webs printed in a sheet-fed or web-fed, rotary offset printing press, herein generally designated 12. In this instance, as shown in FIGURE 1, the inking/coating apparatus 10 is installed in a four unit rotary offset printing press 12, such as that manufactured by Heidelberger Druckmaschinen AG of Germany under its designation Heidelberg Speedmaster SM102 (40", 102cm).

The press 12 includes a press frame 14 coupled at one end, herein the right end, to a sheet feeder 16 from which sheets, herein designated S, are individually and sequentially fed into the press, and at the opposite end,

with a sheet delivery stacker 20 in which the freshly printed sheets are collected and stacked. Interposed between the sheet feeder 16 and the sheet delivery stacker 20 are four substantially identical sheet printing units 22, 24, 26 and 28 which can print four different colors onto the sheets as they are transferred through the press 12. The printing units are housed within printing towers T1, T2, T3 and T4 formed by side frame members 14, 15. Each printing tower has a delivery side 25 and a dampener side 27. A dampener space 29 is partially enclosed by the side frames on the dampener side of the printing unit.

As illustrated, the printing units 22, 24, 26 and 28 are substantially identical and of conventional design. The first printing unit 22 includes an in-feed transfer cylinder 30, a plate cylinder 32, a blanket cylinder 34 and an impression cylinder 36, all supported for rotation in parallel alignment between the press side frames 14, 15 which define printing unit towers T1, T2, T3 and T4. Each of the first three printing units 22, 24 and 26 have a transfer cylinder 38 disposed to transfer the freshly printed sheets from the adjacent impression cylinder and transfer the freshly printed sheets to the next printing unit via an intermediate transfer drum 40.

The last printing unit 28 includes a delivery cylinder 42 mounted on a delivery shaft 43. The delivery cylinder 42 supports the freshly printed sheet 18 as it is transferred from the last impression cylinder 36 to a delivery conveyor system, generally designated 44, which transfers the freshly printed sheet to the sheet delivery stacker 20. To prevent smearing during transfer, a flexible covering is mounted on the delivery cylinder 42, as described and claimed in U.S. Patent 4,402,267 to Howard W. DeMoore, which is incorporated herein by reference. The flexible covering is manufactured and sold by Printing Research, Inc. of Dallas, Texas, U.S.A., under its trademark SUPER BLUE®. Optionally, a vacuum-assisted sheet transfer assembly manufactured and sold by Printing Research, Inc. of Dallas, Texas, U.S.A., under its trademark BACVAC® can be substituted for the delivery transfer cylinder 42 and flexible covering.

The delivery conveyor system 44 as shown in FIGURE 2 is of conventional design and includes a pair of endless delivery gripper chains 46, only one of which is shown carrying at regular spaced locations along the chains, laterally disposed gripper bars having gripper fingers used to grip the leading edge of a freshly printed or coated sheet 18 after it leaves the nip between the impression cylinder 36 and delivery cylinder 42 of the last printing unit 28. As the leading edge is gripped by the gripper fingers, the delivery chains 46 pull the sheet away from the last impression cylinder 36 and convey the freshly printed or coated sheet to the sheet delivery stacker 20.

Prior to reaching the delivery sheet stacker, the freshly printed and/or coated sheets S pass under a delivery dryer 48 which includes a combination of infrared thermal radiation, high velocity hot air flow and a high performance heat and moisture extractor for drying the ink and/or the protective/decorative coating. Preferably, the delivery dryer 48, including the high performance heat and moisture extractor is constructed as described in U.S. Application Serial Number 08/116,711, filed September 3, 1993, entitled "Infra-Red Forced Air Dryer and Extractor" by Howard C. Secor, Ronald M. Rendleman and Paul D. Copenhaver, commonly assigned to the assignee of the present invention, Howard W. DeMoore, and licensed to Printing Research, Inc. of Dallas, Texas, U.S.A., which manufactures and markets the delivery dryer 48 under its trademark AIR BLANKET™.

In the exemplary embodiment shown in FIGURE 3, the first printing unit 22 has a flexographic printing plate PF mounted on the plate cylinder, and therefore neither an inking roller train nor a dampening system is required. A flexographic printing plate PF is also mounted on the plate cylinder of the second printing unit 24. The form rollers of the inking roller train 52 shown mounted on the second printing unit 24 are retracted and locked off to prevent plate contact. Flexographic ink is supplied to the flexographic plate PF of the second printing unit 24 by the inking/coating apparatus 10.

A suitable flexographic printing plate PF is offered by E.I. du Pont de Nemours of Wilmington, Delaware, U.S.A., under its trademark CYREL®. Another source is BASF Aktiengesellschaft of Ludwigshafen, Germany, which offers a suitable flexographic printing plate under its trademark NYLOFLEX®.

The third printing unit 26 as illustrated in FIGURE 3 and FIGURE 4 is equipped for lithographic printing and includes an inking apparatus 50 having an inking roller train 52 arranged to transfer ink Q from an ink fountain 54 to a lithographic plate P mounted on the plate cylinder 32. This is accomplished by a fountain roller 56 and a ductor roller 57. The fountain roller 56 projects into the ink fountain 54, whereupon its surface picks up ink. The lithographic printing ink Q is transferred from the fountain roller 56 to the inking roller train 52 by the ductor roller 57. The inking roller train 52 supplies ink Q to the image areas of the lithographic printing plate P.

The lithographic printing ink Q is transferred from the lithographic printing plate P to an ink receptive blanket B which is mounted on the blanket cylinder 34. The inked image carried on the blanket B is transferred to a substrate S as the substrate is transferred through the nip between the blanket cylinder 34 and the impression cylinder 36.

The inking roller arrangement 52 illustrated in FIGURE 3 and FIGURE 4 is exemplary for use in combination with lithographic ink printing plates P. It is understood that a dampening system 58 having a dampening fluid reservoir DF is coupled to the inking roller train 52 (FIGURE 4), but is not required for waterless or flexographic printing.

The plate cylinder 32 of printing unit 28 is equipped with a waterless printing plate PW. Waterless printing plates are also referred to as dry planographic printing

plates and are disclosed in the following U.S. patents: 3,910,187; Re. 30,670; 4,086,093; and 4,853,313. Suitable waterless printing plates can be obtained from Toray Industries, Inc of Tokyo, Japan. A dampening system is not used for waterless printing, and waterless (oil-based) printing ink is used. The waterless printing plate PW has image areas and non-image areas which are oleophilic/hydrophilic and oleophobic/hydrophobic, respectively. The waterless printing plate PW is engraved or etched, with the image areas being recessed with respect to the non-image areas. The image area of the waterless printing plate PW is rolled-up with the flexographic or aqueous printing ink which is transferred by the applicator roller 66. Both aqueous and oil-based inks and coatings are repelled from the non-image areas, and are retained in the image areas. The printing ink or coating is then transferred from the image areas to an ink or coating receptive blanket B and is printed or coated onto a substrate S.

For some printing jobs, a flexographic plate PF or a waterless printing plate PW is mounted over a resilient packing such as the blanket B on the blanket cylinder 34, for example as indicated by phantom lines in printing unit 22 of FIGURE 5. An advantage of this alternative embodiment is that the waterless plate PW or the flexographic plate PF are resiliently supported over the blanket cylinder by the underlying blanket B or other resilient packing. The radial deflection and give of the resilient blanket B provides uniform, positive engagement between the applicator roller 66 and a flexographic plate or waterless plate.

In that arrangement, a plate is not mounted on the plate cylinder 32; instead, a waterless plate PW is mounted on the blanket cylinder, and the inked image on the waterless printing plate is not offset but is instead transferred directly from the waterless printing plate PW to the substrate S. The water component of flexographic ink on the freshly printed sheet is evaporated by high velocity, hot air dryers and high volume heat and moisture extractors so that the freshly printed aqueous or flexographic ink is dried before the substrate is printed on the next printing unit.

Referring now to FIGURE 2, FIGURE 3 and FIGURE 9, the inking/coating apparatus 10 is pivotally mounted on the side frames 14, 15 for rotation about an axis X. The inking/coating apparatus 10 includes a frame 60, a hydraulic motor 62, a lower gear train 64, an upper gear train 65, an applicator roller 66, a sealed doctor blade assembly 68 (FIGURE 6), and a drip pan DP, all mounted on the frame 60. The external peripheral surface of the applicator roller 66 is wetted by contact with liquid coating material or ink contained in a reservoir 70.

The hydraulic motor 62 drives the applicator roller 66 synchronously with the plate cylinder 32 and the blanket cylinder 34 in response to an RPM control signal from the press drive (not illustrated) and a feedback signal developed by a tachometer 72. While a hydraulic drive motor is preferred, other drive means such as an electric drive motor or an equivalent can be used.

When using waterless printing plate systems, the temperature of the waterless printing ink and of the waterless printing plate must be closely controlled for good image reproduction. For example, for waterless offset printing with TORAY waterless printing plates PW, it is absolutely necessary to control the waterless printing plate surface and waterless ink temperature to a very narrow range, for example 24°C (75°F) to 27°C (80°F)

Referring to FIGURE 7, the reservoir 70 is supplied with ink or coating which is temperature controlled by a heat exchanger 71. The temperature controlled ink or coating material is circulated by a positive displacement pump, for example a peristaltic pump, through the reservoir 70 and heat exchanger 71 from a source 73 through a supply conduit 75 and a return conduit 77. The heat exchanger 71 cools or heats the ink or coating material and maintains the ink or coating and the printing plate within the desired narrow temperature range.

According to one aspect of the present invention, aqueous/flexographic ink or coating material is supplied to the applicator roller 66, which transfers the aqueous/flexographic ink or coating material to the printing plate (FIGURE 7), which may be a waterless printing plate or a flexographic printing plate. When the inking/coating apparatus is used for applying aqueous/flexographic ink or coating material to a waterless printing plate PW, the inking roller train 52 is not required, and is retracted away from the printing plate. Because the viscosity of aqueous/flexographic printing ink or coating material varies with temperature, it is necessary to heat or cool the aqueous/flexographic printing ink or coating material to compensate for ambient temperature variations to maintain the ink viscosity in a preferred operating range.

For example, the temperature of the printing press can vary from around 60°F (15°C) in the morning, to around 85°F (29°C) or more in the afternoon. The viscosity of aqueous/flexographic printing ink or coating material can be marginally high when the ambient temperature of the press is near 60°F (15°C), and the viscosity can be marginally low when the ambient temperature of the press exceeds 85°F (29°C). Consequently, it is desirable to control the temperature of the aqueous/flexographic printing ink or coating material so that it will maintain the surface temperature of waterless printing plates within the specified temperature range. Moreover, the ink/coating material temperature should be controlled to maintain the tack of the aqueous/flexographic printing ink or coating material within a desired range when the ink or coating material is being used in connection with flexographic printing processes.

The applicator roller 66 is preferably an anilox fluid metering roller which transfers measured amounts of printing ink or coating material to a plate or blanket. The surface of an anilox roller is engraved with an array of closely spaced, shallow depressions referred as "cells". Ink or coating from the reservoir 70 flows into the cells

as the anilox roller turns through the reservoir. The transfer surface of the anilox roller is "doctored" (wiped or scraped) by dual doctor blades 68A, 68B to remove excess ink or coating material. The ink or coating metered by the anilox roller is that contained within the cells. The dual doctor blades 68A, 68B also seal the supply reservoir 70.

The anilox applicator roller 66 is cylindrical and may be constructed in various diameters and lengths, containing cells of various sizes and shapes. The volumetric capacity of an anilox roller is determined by cell size, shape and number of cells per unit area. Depending upon the intended application, the cell pattern may be fine (many small cells per unit area) or coarse (fewer large cells per unit area).

By supplying the ink or coating material through the inking/coating apparatus 10, more ink or coating material can be applied to the sheet S as compared with the inking roller train of a lithographic printing unit. Moreover, color intensity is stronger and more brilliant because the aqueous or flexographic ink or coating material is applied at a much heavier film thickness or weight than can be applied by the lithographic process, and the aqueous or flexographic colors are not diluted by dampening solution.

Preferably, the sealed doctor blade assembly 68 is constructed as described in U.S. Patent 5,176,077 to Howard W. DeMoore, co-inventor and assignee, which is incorporated herein by reference. An advantage of using a sealed reservoir is that fast drying ink or coating material can be used. Fast drying ink or coating material can be used in an open fountain 53 (see FIGURE 8); however, open air exposure causes the water and solvents in the fast-drying ink or coating material to evaporate faster, thus causing the ink or coating material to dry prematurely and change viscosity. Moreover, an open fountain emits unwanted odors into the press room. When the sealed doctor blade assembly is utilized, the pump (FIGURE 7) which circulates ink or coating material to the doctor blade head is preferably a peristaltic pump, which does not inject air into the feeder lines which supply the ink or coating reservoir 70 and helps to prevent the formation of air bubbles and foam within the ink or coating material.

An inking/coating apparatus 10 having an alternative applicator roller arrangement is illustrated in FIGURES 10-13. In this arrangement, the engraved metering surface of the anilox applicator rollers 66, 67 are partitioned by smooth seal surfaces 66C which separates a first engraved peripheral surface portion 66A from a second engraved peripheral surface portion 66B. Likewise, smooth seal surfaces 66D, 66E are formed on the opposite end portions of the applicator roller 66 for engaging end seals 134, 136 (FIGURE 12) of the doctor blade reservoir. The upper applicator roller 67 has engraved anilox metering surfaces 67A and 67B which are separated by a smooth seal band 67C.

Referring now to FIGURE 12 and FIGURE 13, the reservoir 70 of the doctor blade head 68 is partitioned by a curved seal element 130 to form two separate chambers 70A, 70B. The seal element 130 is secured to the doctor blade head within an annular groove 132. The seal element 130 is preferably made of polyurethane foam or other durable, resilient foam material. The seal element 130 is engaged by the seal band 66, thus forming a rotary seal which blocks the leakage of ink or coating material from one reservoir chamber into the other reservoir chamber. Moreover, the seal band provides an unprinted or uncoated area which separates the printed or coated areas from each other, which is needed for work and turn printing jobs or other printing jobs which print two or more separate images onto the same substrate.

Another advantage of the split applicator roller embodiment is that it enables two or more flexographic inks or coating materials to be printed simultaneously within the same lithographic printing unit. That is, the reservoir chambers 70A, 70B of the upper doctor blade assembly can be supplied with gold ink and silver ink, for example, while the reservoir chambers 70A, 70B of the lower doctor blade assembly can be supplied with inks of two additional colors, for example opaque white ink and blue ink. This permits the opaque white ink to be overprinted with the gold ink, and the blue ink to be overprinted with the silver ink on the same printing unit on any lithographic press.

Moreover, a catalyst can be used in the upper doctor blade reservoir and a reactive ink or coating material can be used in the lower doctor blade reservoir. This can provide various effects, for example improved chemical resistance and higher gloss levels.

The split applicator roller sections 67A, 67B in the upper cradle position can be used for applying two separate inks or coating materials simultaneously, for example flexographic, aqueous and ultra-violet curable inks or coating materials, to separate surface areas of the plate, while the lower applicator roller sections 66A, 66B can apply an initiator layer and a micro-encapsulated layer simultaneously to separate blanket surface areas. Optionally, the metering surface portions 66A, 66B can be provided with different cell metering capacities for providing different printing effects which are being printed simultaneously. For example, the screen line count on one half-section of an anilox applicator roller is preferably in the range of 200-600 lines per inch (79-236 lines per cm) for half-tone images, and the screen line count of the other half-section is preferably in the range of 100-300 lines per inch (39-118 lines per cm) for overall coverage, high weight applications such as opaque white. This split arrangement in combination with dual applicator rollers is particularly advantageous when used in connection with "work and turn" printing jobs.

Referring again to FIGURE 8, instead of using the sealed doctor blade reservoir assembly 68 as shown in FIGURE 6, an open fountain assembly 69 is provided by the fountain pan 53 which contains a volume of liquid ink Q or coating material. The liquid ink or coating material

is transferred to the applicator roller 66 by a pan roller 55 which turns in contact with ink Q or coating material in the fountain pan. If a split applicator roller is used, the pan roller 55 is also split, and the pan is divided into two pan sections 53A, 53B by a separator plate 53P, as shown in FIGURE 16.

In the alternative embodiment of FIGURE 16, the pan roller 55 is divided into two pan roller sections 55A, 55B by a centrally located, annular groove 59. The separator plate 53P is received within and centrally aligned with the groove 59, but does not touch the adjoining roller faces. By this arrangement, two or more inks or coating materials Q1, Q2 are contained within the open pan sections 55A, 55B for transfer by the split pan roller sections 53A, 53B, respectively. This permits two or more flexographic inks or coating materials to be transferred to two separate image areas on the plate or on the blanket of the same printing unit. This arrangement is particularly advantageous for work and turn printing jobs or other printing jobs which print two or more separate images onto the same substrate.

The frame 60 of the inking/coating apparatus 10 includes side support members 74, 76 which support the applicator roller 66, gear train 64, gear train 65, doctor blade assembly 68 and the drive motor 62. The applicator roller 66 is mounted on stub shafts 63A, 63B which are supported at opposite ends on a lower cradle assembly 100 formed by a pair of side support members 78, 80 which have sockets 79, 81 and retainer caps 101, 103. The stub shafts are received in roller bearings 105, 107 which permit free rotation of the applicator roller 66 about its longitudinal axis A1 (axis A2 in the upper cradle). The retainer caps 101, 103 hold the stub shafts 63A, 63B and bearings 105, 107 in the sockets 79, 81 and hold the applicator roller 66 in parallel alignment with the pivot axis X.

The side support members 74, 76 also have an upper cradle assembly 102 formed by a pair of side support members 82, 84 which are vertically spaced with respect to the lower side plates 78, 80. Each cradle 100, 102 has a pair of sockets 79, 81 and 83, 85, respectively, for holding an applicator roller 66, 67 for spot coating or inking engagement with the printing plate P on the plate cylinder 32 (FIGURE 4) or with a printing plate P or a blanket B on the blanket cylinder 34.

Preferably, the applicator roller 67 (FIGURE 8, FIGURE 9) the upper cradle (plate) position is an anilox roller having a resilient transfer surface. In the dual cradle arrangement as shown in FIGURE 2, the press operator can quickly change from blanket inking/coating to plate inking/coating within minutes, since it is only necessary to release, remove and reposition or replace the applicator roller 66

The capability to simultaneously print in the flexographic mode, the aqueous mode, the waterless mode, or the lithographic mode on different printing units of the same lithographic press and to print or coat from either the plate position or the blanket position on any one of the printing units is referred to herein as the LITHOFLEX™ printing process or system. LITHOFLEX™ is a trademark of Printing Research, Inc. of Dallas, Texas, U.S.A., exclusive licensee of the present invention.

Referring now to FIGURE 14, an inking/coating apparatus 10 having an inking/coating assembly 109 of an alternative design is installed in the upper cradle position for applying ink and/or coating material to a plate P on the plate cylinder 32. According to this alternative embodiment, an applicator roller 67R having a resilient transfer surface is coupled to an anilox fluid metering roller which transfers measured amounts of printing ink or coating material to the plate P. The anilox roller 111 has a transfer surface constructed of metal, ceramic or composite material which is engraved with cells. The resilient applicator roller 67R is interposed in transfer engagement with the plate P and the metering surface of the anilox roller 111. The resilient transfer surface of the applicator roller 67R provides uniform, positive engagement with the plate.

Referring now to FIGURE 17, an inking/coating apparatus 10 having an alternative inking/coating assembly 113 is installed in the lower cradle assembly 100 for applying flexographic or aqueous ink and/or coating material Q to a plate or blanket mounted on the blanket cylinder 34. Instead of using the sealed, dual doctor blade reservoir assembly 68 as shown in FIGURE 6, an open, single doctor blade anilox roller assembly 113 is supplied with liquid ink Q or coating material contained in an open fountain pan 117. The liquid ink or coating material Q is transferred to the engraved transfer surface of the anilox roller 66 as it turns in the fountain pan 117. Excess ink or coating material Q is removed from the engraved transfer surface by a single doctor blade 68B. The liquid ink or coating material Q is pumped from an off-press source, for example the drum 73 shown in FIGURE 17, through a supply conduit 119 into the fountain pan 117 by a pump 120.

For overall inking or coating jobs, the metering transfer surface of the anilox roller 66 extends over its entire peripheral surface. However, for certain printing jobs which print two or more separate images onto the same substrate, for example work and turn printing jobs, the metering transfer surface of the anilox applicator roller 66 is partitioned by a centrally located, annular undercut groove 66C which separates first and second metering transfer surfaces 66A, 66B as shown in FIGURE 11 and FIGURE 18.

The single doctor blade 68B has an edge 68E which wipes simultaneously against the split metering transfer surfaces 66A, 66B. In this single blade, split anilox roller embodiment 113, it is necessary to provide dual supply sources, for example drums 73A, 73B, dual supply lines 119A, 119B, and dual pumps 120A, 120B. Moreover, the fountain pan 117 is also split, and the pan 117 is divided into two pan sections 117A, 117B by a separator plate 121, as shown in FIGURE 18. The separator plate 121 is centrally aligned with the undercut

groove 66C, but does not touch the adjoining roller faces.

Although the single blade, split anilox applicator roller assembly 113 is shown mounted in the lower cradle position (FIGURE 17), it should be understood that the single blade, split anilox applicator roller assembly 113 can be mounted and used in the upper cradle position, as well.

According to another aspect of the present invention, the inking/coating apparatus 10 is pivotally coupled on horizontal pivot pins 88P, 90P which allows the single head, dual cradle inking/coating apparatus 10 to be mounted on any lithographic printing unit. Referring to FIGURE 9, the horizontal pivot pins 88P, 90P are mounted within the traditional dampener space 29 of the printing unit and are secured to the press side frames 14, 15, respectively. Preferably, the pivot support pins 88P, 90P are secured to the press side frames by a threaded fastener. The pivot support pins are received within circular openings 88, 90 which intersect the side support members 74, 76 of the inking/coating apparatus 10. The horizontal support pins 88P, 90P are disposed in parallel alignment with rotational axis X and with the plate cylinder and blanket cylinder, and are in longitudinal alignment with each other.

Preferably, the pivot pins 88P, 90P are located in the dampener space 29 so that the rotational axes A1, A2 of the applicator rollers 66, 67 are elevated with respect to the nip contact points N1, N2. By that arrangement, the transfer point between the applicator roller 66 and a blanket on the blanket cylinder 34 (as shown in FIGURE 8) and the transfer point between the applicator roller 66 and a plate on the plate cylinder 32 (as shown in FIGURE 5) are above the radius lines R1, R2 of the plate cylinder and the blanket cylinder, respectively. This permits the inking/coating apparatus 10 to move clockwise to retract the applicator roller 66 to an off-impression position relative to the blanket cylinder in response to a single extension stroke of the power actuator arms 104A, 106A. Similarly, the applicator roller 66 is moved counterclockwise to the on-impression operative position as shown in FIGURES 4, 5, 6 and 8 by a single retraction stroke of the actuator arms 104A, 106A, respectively.

Preferably, the pivot pins are made of steel and the side support members are made of aluminum, with the steel pivot pins and the aluminum collar portion bordering the circular openings 88, 90 forming a low friction journal. By this arrangement, the inking/coating apparatus 10 is freely rotatable clockwise and counterclockwise with respect to the pivot pins 88P, 90P. Typically, the arc length of rotation is approximately 60 mils (about 1.5 mm). Consequently, the inking/coating apparatus 10 is almost totally enclosed within the dampener space 29 of the printing unit in the on-impression position and in the off-impression position.

The cradle assemblies 100 and 102 position the applicator roller 66 in inking/coating alignment with the plate cylinder or blanket cylinder, respectively, when the inking/coating apparatus 10 is extended to the operative (on-impression) position. Moreover, because the inking/coating apparatus 10 is installed within the dampener space 29, it is capable of freely rotating through a small arc while extending and retracting without being obstructed by the press side frames or other parts of the printing press. This makes it possible to install the inking/coating apparatus 10 on any lithographic printing unit. Moreover, because of its internal mounting position within the dampener space 29, the projection of the inking/coating apparatus 10 into the space between printing units is minimal. This assures unrestricted operator access to the printing unit when the applicator head is in the operative (on-impression) and retracted (off-impression) positions.

As shown in FIGURE 4 and FIGURE 5, movement of the inking/coating apparatus 10 is counterclockwise from the retracted (off-impression) position to the operative (on-impression) position.

Although the dampener side installation is preferred, the inking/coating apparatus 10 can be adapted for operation on the delivery side of the printing unit, with the inking/coating apparatus being movable from a retracted (off-impression) position to an on-impression position for engagement of the applicator roller with either a plate on the plate cylinder or a blanket on the blanket cylinder on the delivery side 25 of the printing unit.

Movement of the inking/coating apparatus 10 to the operative (on-impression) position is produced by power actuators, preferably double acting pneumatic cylinders 104, 106 which have extendable/retractable power transfer arms 104A, 106A, respectively. The first pneumatic cylinder 104 is pivotally coupled to the press frame 14 by a pivot pin 108, and the second pneumatic cylinder 106 is pivotally coupled to the press frame 15 by a pivot pin 110. In response to selective actuation of the pneumatic cylinders 104, 106, the power transfer arms 104A, 106A are extended or retracted. The power transfer arm 104A is pivotally coupled to the side support member 74 by a pivot pin 112. Likewise, the power transfer arm 106A is pivotally coupled to the side support member 76 by a pivot pin 114.

As the power arms extend, the inking/coating apparatus 10 is rotated clockwise on the pivot pins 88P, 90P, thus moving the applicator roller 66 to the off-impression position. As the power arms retract, the inking/coater apparatus 60 is rotated counterclockwise on the pivot pins 88P, 90P, thus moving the applicator roller 66 to the on-impression position. The torque applied by the pneumatic actuators is transmitted to the inking/coating apparatus 10 through the pivot pin 112 and pivot pin 114.

Fine adjustment of the on-impression position of the applicator roller relative to the plate cylinder or the blanket cylinder, and of the pressure of roller engagement, is provided by an adjustable stop assembly 115. The adjustable stop assembly 115 has a threaded bolt 116 which is engagable with a bell crab 118. The bell

crank 118 is pivotally coupled to the side support member 74 on a pin 120. One end of the bell crank 118 is engagable by the threaded bolt 116, and a cam roller 122 is mounted for rotation on its opposite end. The striking point of engagement is adjusted by rotation of the bolt 116 so that the applicator roller 66 is properly positioned for inking/coating engagement with the plate P or blanket B and provides the desired amount of inking/coating pressure when the inking/coating assembly 60 is moved to the operative position.

This arrangement permits the in-line inking/coating apparatus to operate effectively without encroaching in the interunit space between any adjacent printing units, and without blocking or obstructing access to the cylinders of the printing units when the inking/coating apparatus is in the extended (off-impression) position or retracted (on-impression) position. Moreover, when the in-line inking/coating apparatus is in the retracted position, the doctor blade reservoir and coating circulation lines can be drained and flushed automatically while the printing press is running as well as when the press has been stopped for change-over from one job to another or from one type of ink or coating to another.

Substrates which are printed or coated with aqueous flexographic printing inks require high velocity hot air for drying. When printing a flexographic ink such as opaque white or metallic gold, it is always necessary to dry the printed substrates between printing units before overprinting them. According to the present invention, the water component on the surface of the freshly printed or coated substrate S is evaporated and dried by high velocity, hot air interunit dryer and high volume heat and moisture extractor units 124, 126 and 128, as shown in FIGURE 2, FIGURE 4 and FIGURE 5. The dryer/extractor units 124, 126 and 128 are oriented to direct high velocity heated air onto the freshly printed/coated substrates as they are transferred by the impression cylinder 36 and the intermediate transfer drum 40 of one printing unit and to another transfer cylinder 30 and to the impression cylinder 36 of the next printing unit. By that arrangement, the freshly printed flexographic ink or coating material is dried before the substrate S is overprinted by the next printing unit.

The high velocity, hot air dryer and high performance heat and moisture extractor units 124, 126 and 128 utilize high velocity air jets which scrub and break-up the moist air layer which clings to the surface of each freshly printed or coated sheet or web. Within each dryer, high velocity air is heated as it flows across a resistance heating element within an air delivery baffle tube. High velocity jets of hot air are discharged through multiple airflow apertures into an exposure zone Z (FIGURE 4 and FIGURE 5) and onto the freshly printed/coated sheet S as it is transferred by the impression cylinder 36 and transfer drum 40, respectively.

Each dryer assembly includes a pair of air delivery dryer heads 124D, 126D and 128D which are arranged in spaced, side-by-side relationship. The high velocity, hot air dryer and high performance heat and moisture extractor units 124, 126 and 128 are preferably constructed as disclosed in co-pending U.S. Patent Application Serial No. 08/132,584, filed October 6, 1993, entitled "High velocity Hot Air Dryer", to Howard W. DeMoore, coinventor and assignee of the present invention, and which is incorporated herein by reference, and which is marketed by Printing Research, Inc. of Dallas, Texas, U.S.A., under its trademark SUPER BLUE HV™.

The hot moisture-laden air displaced from the surface of each printed or coated sheet is extracted from the dryer exposure zone Z and exhausted from the printing unit by the high volume extractors 124, 126 and 128. Each extractor head includes an extractor manifold 124E, 126E and 128E coupled to the dryer heads 124D, 126D and 128D and draws the moisture, volatiles, odors and hot air through a longitudinal air gap G between the dryer heads. Best results are obtained when extraction is performed simultaneously with drying. Preferably, an extractor is closely coupled to the exposure zone Z at each dryer location as shown in FIGURE 4. Extractor heads 124E, 126E and 128E are mounted on the dryer heads 124D, 126D and 128D, respectively, with the longitudinal extractor air gap G facing directly into the exposure zone Z. According to this arrangement, each printed or coated sheet is dried before it is printed on the next printing unit.

The aqueous water-based inks used in flexographic printing evaporate at a relatively moderate temperature provided by the interunit high velocity hot air dryers/extractors 124, 126 and 128. Sharpness and print quality are substantially improved since the flexographic ink or coating material is dried before it is overprinted on the next printing unit. Since the freshly printed flexographic ink is dry, dot gain is substantially reduced and back-trapping on the blanket of the next printing unit is virtually eliminated. This interunit drying/extracting arrangement makes it possible to print flexographic inks such as metallic ink and opaque white ink on the first printing unit, and then dry-trap and overprint on the second and subsequent printing units.

Moreover, this arrangement permits the first printing unit 22 to be used as a coater in which a flexographic, aqueous or UV-curable coating material is applied to the lowest grade substrate such as recycled paper, cardboard, plastic and the like, to trap and seal-in lint, dust, spray powder and other debris and provide a smoother, more durable printing surface which can be overprinted on the next printing unit.

A first down (primer) aqueous coating layer seals-in the surface of a low grade, rough substrate, for example, re-cycled paper or plastic, and improves overprinted dot definition and provides better ink lay-down while preventing strike-through and show-through. A flexographic UV-curable coating material can then be applied downstream over the primer coating, thus producing higher coating gloss.

Preferably, the applicator roller 66 is constructed of composite carbon fiber material, metal or ceramic coated metal when it is used for applying ink or coating

material to the blanket B or other resilient material on the blanket cylinder 34. When the applicator roller 66 is applied to the plate, it is preferably constructed as an anilox roller having a resilient, compressible transfer surface. Suitable resilient roller surface materials include Buna N synthetic rubber and EPDM (terpolymer elastomer).

It has been demonstrated in prototype testing that the inking/coating apparatus 10 can apply a wide range of ink and coating types, including fluorescent (Day Glo), pearlescent, metallics (gold, silver and other metals), glitter, scratch and sniff (micro-encapsulated fragrance), scratch and reveal, luminous, pressure-sensitive adhesives and the like, as well as UV-curable and aqueous coatings.

With the dampener assembly removed from the printing unit, the inking/coating apparatus 10 can easily be installed in the dampener space for selectively applying flexographic inks and/or coatings to a flexographic or waterless printing plate or to the blanket. Moreover, overprinting of the flexographic inks and coatings can be performed on the next printing unit since the flexographic inks and/or coatings are dried by the high velocity, hots air interunit dryer and high volume heat and moisture extractor assembly of the present invention.

The flexographic inks and coatings as used in the present invention contain colored pigments and/or soluble dyes, binders which fix the pigments onto the surface of the substrate, waxes, defoamers, thickeners and solvents. Aqueous printing inks predominantly contain water as a diluent and/or vehicle. The thickeners which are preferred include algonates, starch, cellulose and its derivatives, for example cellulose esters or cellulose ethers and the like. Coloring agents including organic as well as inorganic pigments may be derived from dyes which are insoluble in water and solvents. Suitable binders include acrylates and/or polyvinylchloride.

When metallic inks are printed, the cells of the anilox roller must be appropriately sized to prevent the metal particles from getting stuck within the cells. For example, for metallic gold ink, the anilox roller should have a screen line count in the range of 175-300 lines per inch (68-118 lines per cm). Preferably, in, order to keep the anilox roller cells clear, the doctor blade assembly 68 is equipped with a bristle brush BR (FIGURE 14) as set forth in U.S. Patent 5,425,809 to Steven M. Person, assigned to Howard W. DeMoore, and licensed to Printing Research, Inc. of Dallas, Texas, U.S.A., which is incorporated herein by reference.

The inking/coating apparatus 10 can also apply UV-curable inks and coatings. If UV-curable inks and coatings are utilized, ultra-violet dryers/extractors are installed adjacent to the high velocity hot air dryer/extractor units 124, 126 and 128, respectively.

It will be appreciated that the LITHOFLEX™ printing process described herein makes it possible to selectively operate a printing unit of a press in the lithographic printing mode while simultaneously operating another printing unit of the same press in either the flexographic printing mode or in the waterless printing mode, while also providing the capability to print or coat, separately or simultaneously, from either the plate position or the blanket position. The dual cradle support arrangement of the present invention makes it possible to quickly change over from inking/coating on the blanket cylinder position to inking/coating on the plate cylinder position with minimum press down-time, since it is only necessary to remove and reposition or replace the applicator roller 66 while the inking/coating apparatus 10 is in the retracted position. It is only necessary to remove four cap screws, lift the applicator roller 66 from the cradle, and reposition it in the other cradle. All of this can be accomplished in a few minutes, without removing the inking/coating apparatus 10 from the press.

It is possible to spot coat or overall coat from the plate position or from the blanket position with flexographic inks or coatings on one printing unit and then spot coat or overall coat with UV-curable inks or coatings from the plate position or from the blanket position on another printing unit during the same press run. Moreover, the press operator can spot or overall coat from the plate for one job, and then spot and/or overall coat from the blanket on the next job.

The positioning of the applicator roller relative to the plate or blanket is repeatable to a predetermined preset operative position. Consequently, only minor printing unit modifications or alterations may be required for the LITHOFLEX™ process. Although automatic extension and retraction have been described in connection with the exemplary embodiment, extension to the operative (on-impression) position and retraction to a non-operative (off-impression) position can be carried out manually, if desired. In the manual embodiment, it is necessary to latch the inking/coating apparatus 10 to the press side frames 14, 15 in the operative (on-impression) position, and to mechanically prop the inking/coating apparatus in the off-impression (retracted) position.

Referring again to FIGURE 8, an applicator roller 66 is mounted on the lower cradle assembly 100 by side support members 78, 80, and a second applicator roller 66 is mounted on the upper cradle assembly 102 by side support members 82, 84. According to this arrangement, the inking/coating apparatus 10 can apply printing ink and/or coating material to a plate on the plate cylinder, while simultaneously applying printing ink and/or coating material to a plate or a blanket on the blanket cylinder of the same printing unit. When the same color ink is used by the upper and lower applicator rollers from the plate position and from the blanket position simultaneously on the same printing unit, a "double bump" or double inking films or coating layers are applied to the substrate S during a single pass of the substrate through the printing unit. The tack of the two inks or coating materials must be compatible for good transfer during the double bump. Moreover, the inking/coating apparatus 10 can be used for supplying ink or coating material to the blanket cylinder of a rotary off-

set web press, or to the blanket of a dedicated coating unit.

According to conventional bronzing techniques, a metallic (bronze) powder is applied off-line to previously printed substrate which produces a grainy, textured finish or appearance. The on-line application of bronze material by conventional flexographic or lithographic printing will only produce a smooth, continuous appearance. However, a grainy, textured finish is preferred for highest quality printing which, prior to the present invention, could only be produced by off-line methods.

Referring now to FIGURE 14 and FIGURE 15, metallic ink or coating material is applied on-line to the substrate S by simultaneous operation of the upper and lower applicator rollers 67R, 66 to produce an uneven surface finish having a bronze-like textured or grainy appearance. According to the simulated bronzing method of the present invention, the flexographic bronze ink is applied simultaneously to the plate and to the blanket by the dual cradle inking/coating apparatus 10 as shown in FIGURE 14. A resilient applicator roller 67R is mounted in the upper cradle 102, and an anilox applicator roller 66 is mounted on the lower cradle 100. The rollers are supplied from separate doctor blade reservoirs 70. The doctor blade reservoir 70 in the upper cradle position supplies bronze ink or coating material having relatively coarse, metallic particles 140 dispersed in aqueous or flexographic ink. The coarse particle ink or coating material is applied to the plate P by the resilient applicator roller 67R in the upper cradle position 102. At the same time, flexographic and/or bronze ink or coating material having relatively fine, metallic particles 142 is transferred to the blanket B by the anilox roller 66 which is mounted on the lower cradle 100.

The metering surfaces of the upper and lower applicator rollers have different cell sizes and volumetric capacities which accommodate the coarse and fine metallic particles. For example, the anilox roller 111 mounted in the upper cradle position 102 which transfers the coarse metallic particles 140 preferably has a screen line count in the range of 100-300 lines per inch (39-118 lines per cm), and the metering surface of the anilox roller 66 mounted on the lower cradle 100 which transfers the relatively fine metallic particles 142 preferably has a screen line count in the range of 200-600 lines per inch (79-236 lines per cm).

After transfer from the plate to the blanket, the fine metallic particles 142 form a layer over the coarse metallic particles 140. As both bronze layers are offset onto the substrate S, the layer of fine metallic particles 142 is printed onto the substrate S with the top layer of coarse metallic particles 140 providing a textured, grainy appearance. The fine metallic particles 142 cover the substrate which would otherwise be visible in the gaps between the coarse metallic particles 140. The combination of the coarse particle layer over the fine particle layer thus provides a textured, bronzed-like finish and appearance.

Particulate materials other than metal can be used for producing a textured finish. For example, coarse and fine particles of metallized plastic (glitter), mica particles (pearlescent) and the like, can be substituted for the metallic particles for producing unlimited surface variations, appearances and effects. All of the particulate material, including the metallic particles, are preferably in solid, flat platelet form, and have a size dimension suitable for application by an anilox applicator roller. Other particulate or granular material, for example stone grit having irregular form and size, can be used to good advantage.

Solid metal particles in platelet form, which are good reflectors of light, are preferred for producing the bronzed-like appearance and effect. However, various textured finishes, which could have light-reflective properties, can be produced by using granular materials such as stone grit. Most commonly used metals include copper, zinc and aluminum. Other ductile metals can be used, if desired. Moreover, the coarse and fine particles need not be made of the same particulate material. Various effects and textured appearances can be produced by utilizing diverse particulate materials for the coarse particles and the fine particles, respectively. Further, either fine or coarse particle ink or coating material can be printed from the upper cradle position, and either fine or coarse particle ink or coating material can be printed from the lower cradle position, depending on the special or surface finish that is desired.

It will be appreciated that the last printing unit 28 can be configured for additional inking/coating capabilities which include lithographic, waterless, aqueous and flexographic processes. Various substrate surface effects (for example double bump or triple bump inking/coating or bronzing) can be performed on the last printing unit. For triple bump inking/coating, the last printing unit 28 is equipped with an auxiliary in-line inking or coating apparatus 97 as shown in FIGURE 3 and FIGURE 4. The in-line inking or coating apparatus 97 allows the application of yet another film of ink or a protective or decorative layer of coating material over any freshly printed or coated surface effects or special treatments, thereby producing a triple bump. The triple bump is achieved by applying a third film of ink or layer of coating material over the freshly printed or coated double bump simultaneously while the substrate is on the impression cylinder of the last printing unit.

When the in-line inking/coating apparatus 97 is installed, it is necessary to remove the SUPER BLUE® flexible covering from the delivery cylinder 42, and it is also necessary to modify or convert the delivery cylinder 42 for inking/coating service by mounting a plate or blanket B on the delivery cylinder 42, as shown in FIGURE 3 and FIGURE 4. Packing material is placed under the plate or blanket B, thereby packing the plate or blanket B at the correct packed-to-print radial clearance so that ink or coating material will be printed or coated onto the freshly printed substrate S as it transfers through the nip between the plate or blanket B on the converted

delivery cylinder 42 and the last impression cylinder 36. According to this arrangement, a freshly printed or coated substrate is overprinted or overcoated with a third film or layer of ink or coating material simultaneously while a second film or layer of ink or coating material is being over-printed or over-coated on the last impression cylinder 36

The auxiliary inking/coating apparatus 97 and the converted or modified delivery cylinder 42 are mounted on the delivery drive shaft 43. The inking/coating apparatus 97 includes an applicator roller, preferably an anilox applicator roller 97A, for supplying ink or coating material to a plate or blanket B on the modified or converted delivery cylinder 42. The in-line inking/coating apparatus 97 and the modified or converted delivery cylinder 42 are preferably constructed as described in U.S. Patent 5,176,077 to Howard W. DeMoore (co-inventor and assignee), which is hereby incorporated by reference. The in-line inking/coating apparatus 97 is manufactured and sold by Printing Research, Inc. of Dallas, Texas, U.S.A., under its trademark SUPER BLUE EZ COATER™.

After the delivery cylinder 42 has been modified or converted for inking/coating service, and because of the reduced nip clearance imposed by the plate or blanket B, the modified delivery cylinder 42 can no longer perform its original function of guiding and transferring the freshly printed or coated substrate. Instead, the modified or converted delivery cylinder 42 functions as a part of the inking/coating apparatus 97 by printing or coating a third down film of ink or layer of coating material onto the freshly printed or coated substrate as it is simultaneously printed or coated on the last impression cylinder 36. Moreover, the mutual tack between the second down ink film or coating layer and the third down ink film or coating layer causes the overprinted or overcoated substrate to cling to the plate or blanket, thus opposing or resisting separation of the substrate from the plate or blanket.

To remedy this problem, a vacuum-assisted transfer apparatus 99 is mounted adjacent the modified or converted delivery cylinder 42 as shown in FIGURE 3 and FIGURE 4. Another purpose of the vacuum-assisted transfer apparatus 99 is to separate the freshly overprinted or overcoated triple bump substrate from the plate or blanket B as the substrate transfers through the nip. The vacuum-assisted transfer apparatus 99 produces a pressure differential across the freshly overprinted or overcoated substrate as it transfers through the nip, thus producing a separation force onto the substrate and providing a clean separation from the plate or blanket B.

The vacuum-assisted transfer apparatus 99 is preferably constructed as described in U.S. Patent Nos. 5,113,255; 5,127,329; 5,205,217; 5,228,391; 5,243,909; and 5,419,254, all to Howard W. DeMoore, co-inventor, which are incorporated herein by reference. The vacuum-assisted transfer apparatus 99 is manufactured and sold by Printing Research, Inc. of Dallas, Texas, U.S.A. under its trademark BACVAC™.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the present invention as defined by the appended claims.

Claims

1. A method for printing in a rotary offset press of the type including first and second printing units, the first printing unit having a flexographic printing plate, a blanket, an impression cylinder and inking/coating applicator means for applying aqueous or flexographic printing ink or coating material to the flexographic printing plate and/or to the blanket, comprising the following steps performed in succession in the first printing unit:

    applying a first spot or overall coating of aqueous or flexographic printing ink or coating material to the flexographic printing plate;
    transferring the aqueous or flexographic printing ink or coating material from the flexographic printing plate to the blanket;
    applying a second spot or overall film of aqueous or flexographic printing ink or layer of coating material to the blanket;
    transferring ink or coating material from the blanket to a substrate as the substrate is transferred through the nip between the blanket and the impression cylinder; and,
    drying the aqueous or flexographic ink or coating material on the freshly printed or coated substrate before the substrate is printed, coated or otherwise processed on the second printing unit.

2. The printing method as defined in claim 1, including the steps:

    applying a primer coating of an aqueous or flexographic ink or coating material to a substrate in the first printing unit;
    trapping and sealing particulate material such as dust, lint, anti-offset spray powder and the like under the primer coating;
    drying the primer coating on the substrate before the substrate is printed or coated on the second printing unit; and,
    overprinting the freshly coated substrate in the second printing unit.

3. The printing method as defined in claim 1,
    wherein the drying step is performed by directing heated air onto the freshly printed or coated substrate while the freshly printed or coated substrate is in contact with the impression cylinder

of the first printing unit.

4. The printing method as defined in claim 1, including the steps:

transferring the freshly printed or coated substrate to an intermediate transfer cylinder disposed between the first and second printing units; and,
drying the freshly printed or coated substrate while said substrate is in contact with the intermediate transfer cylinder.

5. The printing method as defined in claim 1, wherein:

the drying step is performed by directing heated air onto the freshly printed or coated substrate while the freshly printed or coated substrate is in contact with an impression cylinder in the second printing unit.

6. The printing method as defined in claim 1, wherein the drying step is performed by directing heated air from a dryer onto the freshly printed or coated substrate, and including the step:

extracting hot air, moisture and volatiles from an exposure zone between the freshly printed or coated substrate and the dryer while the freshly printed or coated substrate is in contact with the impression cylinder of the first printing unit.

7. The printing method as defined in claim 1, including the steps:

transferring the freshly printed or coated substrate to an intermediate transfer cylinder disposed between the first and second printing units;
directing heated air from a dryer onto the freshly printed or coated substrate while said substrate is in contact with the intermediate transfer cylinder; and,
extracting hot air, moisture and volatiles from an exposure zone between the freshly printed or coated substrate and said dryer while the freshly printed or coated substrate is in contact with the intermediate transfer cylinder.

8. The printing method as defined in claim 1, including the steps:

transferring the freshly printed or coated substrate to an impression cylinder on the second printing unit;
directing heated air from a dryer onto the freshly printed or coated substrate while said substrate is in contact with the impression cylinder of the second printing unit; and,
extracting hot air, moisture and volatiles from an exposure zone between the freshly printed or coated substrate and said dryer while said substrate is in contact with the impression cylinder of the second printing unit.

9. A method for providing an uneven printed or coated layer on a substrate in a rotary offset printing press of the type including a printing unit having a plate cylinder, a flexographic printing plate mounted on the plate cylinder, a blanket cylinder, a plate or blanket mounted on the blanket cylinder, an impression cylinder and applicator means for applying aqueous or flexographic printing ink or coating material to the flexographic printing plate and/or to the plate or blanket on the blanket cylinder, comprising the following steps performed in succession in the printing unit:

applying a first down layer of aqueous or flexographic ink or coating material containing relatively coarse particles to the flexographic plate;
transferring the relatively coarse particle printing ink or coating material from the flexographic printing plate to the plate or blanket on the blanket cylinder;
applying a second down layer of aqueous or flexographic printing ink or coating material containing relatively fine particles onto the relatively coarse particle printing ink or coating material;
transferring the coarse and fine particle ink or coating material from the blanket or plate on the blanket cylinder onto a substrate as the substrate is transferred through the nip between the blanket cylinder and the impression cylinder; and,
drying the freshly printed or coated substrate before the freshly printed or coated substrate is subsequently printed, coated or otherwise processed.

10. The method as set forth in claim 9, wherein the coarse and fine particles comprise a metal selected from the group including copper, zinc and aluminum.

11. The method as set forth in claim 9, wherein the coarse and fine particles comprise a non-metallic material selected from the group consisting of mica, silicon, stone grit and plastic.

12. The method as set forth in claim 9, wherein the coarse and fine particles comprise diverse particulate materials, respectively.

13. A method for printing or coating a substrate on the last printing unit of a rotary offset printing press of

the type including a plate cylinder, a printing plate mounted on the plate cylinder, a blanket cylinder, a plate or blanket mounted on the blanket cylinder, an impression cylinder, inking/coating apparatus for applying printing ink or coating material simultaneously or separately to the flexographic printing plate and/or to the plate or blanket on the blanket cylinder, and including an inking/coating cylinder mounted adjacent the last printing unit for printing a film of ink or layer of coating material over a freshly printed substrate, comprising the steps:

applying a first down film of printing ink or layer of coating material to the printing plate;
transferring printing ink or coating material from the printing plate to a plate or blanket on the blanket cylinder;
applying a second down film of printing ink or layer of coating material over the first down film or layer on the plate or blanket on the blanket cylinder;
transferring ink or coating material from the blanket or plate on the blanket cylinder onto a substrate as the substrate is transferred through the nip between the blanket cylinder and the impression cylinder; and
simultaneously printing a third down film of printing ink or layer of coating material over the second down film of ink or layer of coating material while the second down film or layer is being printed or coated on the last impression cylinder.

14. A method for printing or coating a substrate in a rotary offset printing press of the type including a printing unit having a plate cylinder, a flexographic printing plate mounted on the plate cylinder, a blanket cylinder, a plate or blanket mounted on the blanket cylinder, an impression cylinder, and inking/coating apparatus for applying flexographic or aqueous printing ink or coating material to the flexographic printing plate and/or to the plate or blanket on the blanket cylinder, comprising the following steps:

applying a first down film or layer of flexographic or aqueous printing ink or coating material to the flexographic printing plate;
transferring printing ink or coating material from the flexographic printing plate to the plate or blanket on the blanket cylinder;
applying a second down film or layer of aqueous or flexographic printing ink or coating material over the first down film or layer on the plate or blanket on the blanket cylinder;
transferring ink or coating material from the blanket or plate on the blanket cylinder onto a substrate as the substrate is transferred through the nip between the blanket cylinder and the impression cylinder; and
drying the freshly printed or coated substrate before the substrate is subsequently printed, coated or otherwise processed.

15. A method of printing or coating a substrate in a rotary offset printing press as set forth in claim 14, wherein the printing unit is the last printing unit of the rotary offset printing press and a delivery cylinder is mounted on the last printing unit for transferring the freshly printed substrate along a substrate travel path, including the steps:

modifying the delivery cylinder by mounting a plate or blanket on the delivery cylinder;
transferring ink or coating material to the plate or blanket on the modified delivery cylinder; and
transferring a third down film or layer of aqueous or flexographic printing ink or coating material from the plate or blanket over the second down film or layer simultaneously while the freshly printed or coated substrate is on the last impression cylinder of the last printing unit.

16. A method for rotary offset printing as defined in any one of claims 1, 9, 13 or 14, including the steps:

circulating liquid ink or coating material from a supply container to said inking/coating applicator means and from said inking/coating applicator means to the supply container; and,
heating or cooling the liquid ink or coating material as it is circulated.

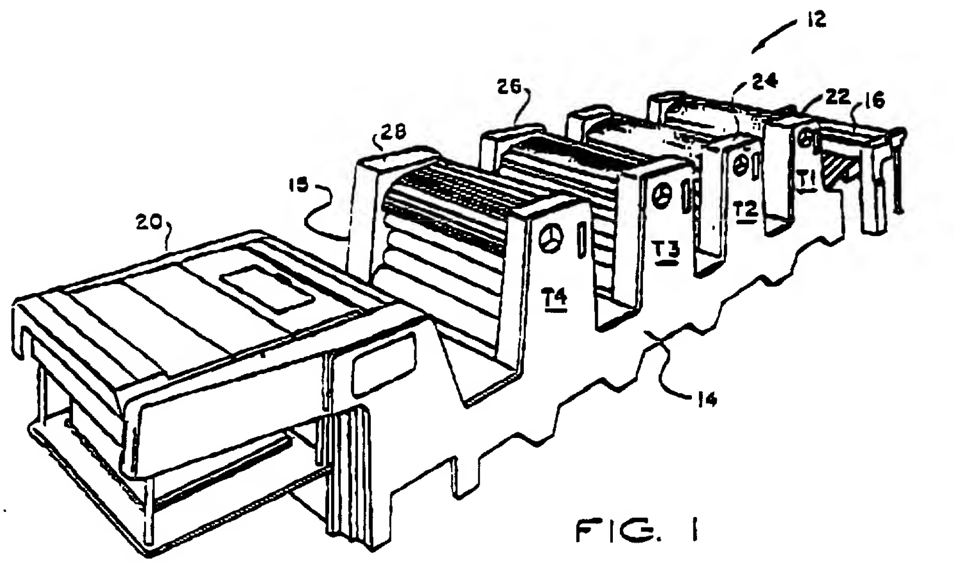
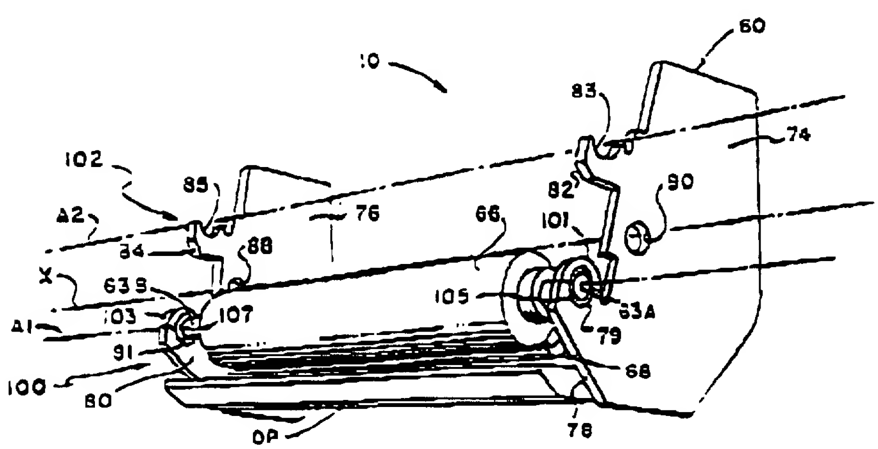

12
24
22
16
26
28
15
20
T1
T2
T3
T4
14

FIG. 1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10
83
74
102
85
82
90
A2
76
66
101
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X
63B
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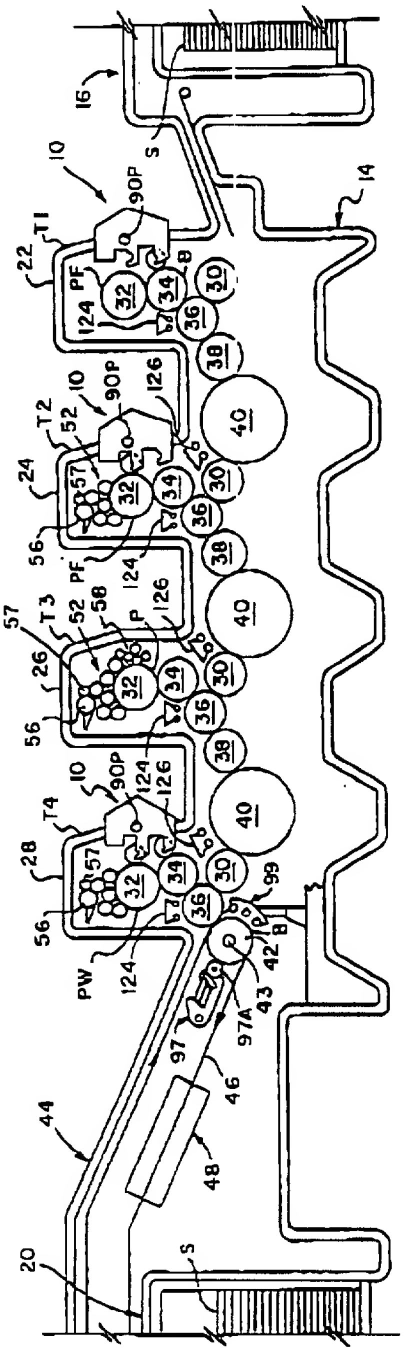
107
63A
A1
103
79
91
68
100
80
78
DP

FIG. 2


16
S
10
90P
14
T1
22
PF
B
32
34
30
124
36
38
10
90P
126
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40
24
57
56
PF
124
126
57
T3
52
58
P
26
56
10
90P
124
126
T4
28
57
56
PW
99
B
42
43
97A
97
46
44
48
20
S

FIG. 3

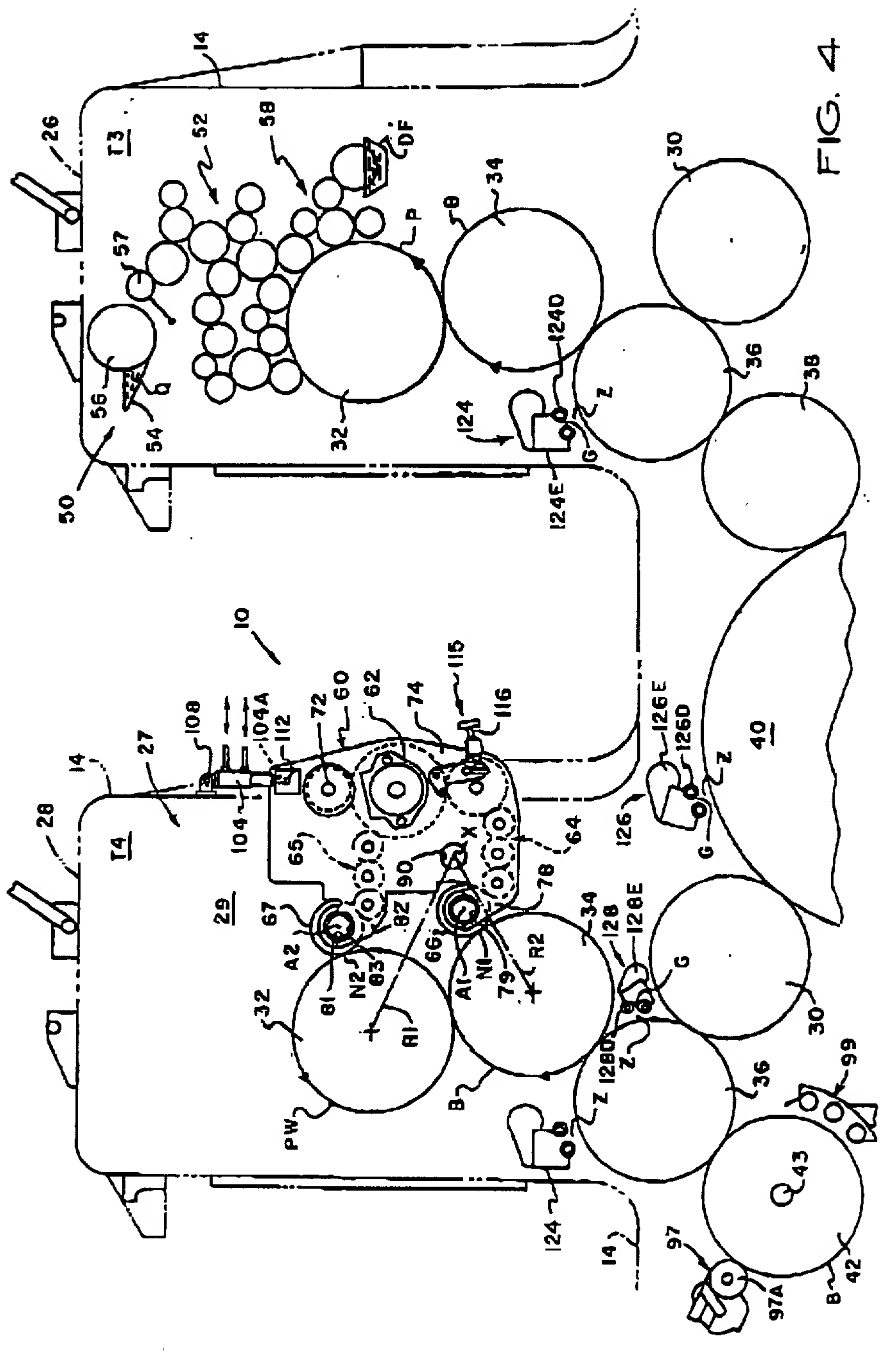

14
26
T3
52
58
DF
57
P
8
34
30
56
54
32
124D
124
36
38
Z
G
50
124E
10
40
108
104A
112
72
60
62
74
115
116
126E
126D
27
T4
104
65
X
90
64
28
29
67
82
78
128
128E
A2
N2
83
66
A1
N1
R2
79
B1
R1
128D
PW
B
124
97
97A
99
43
42

FIG. 4

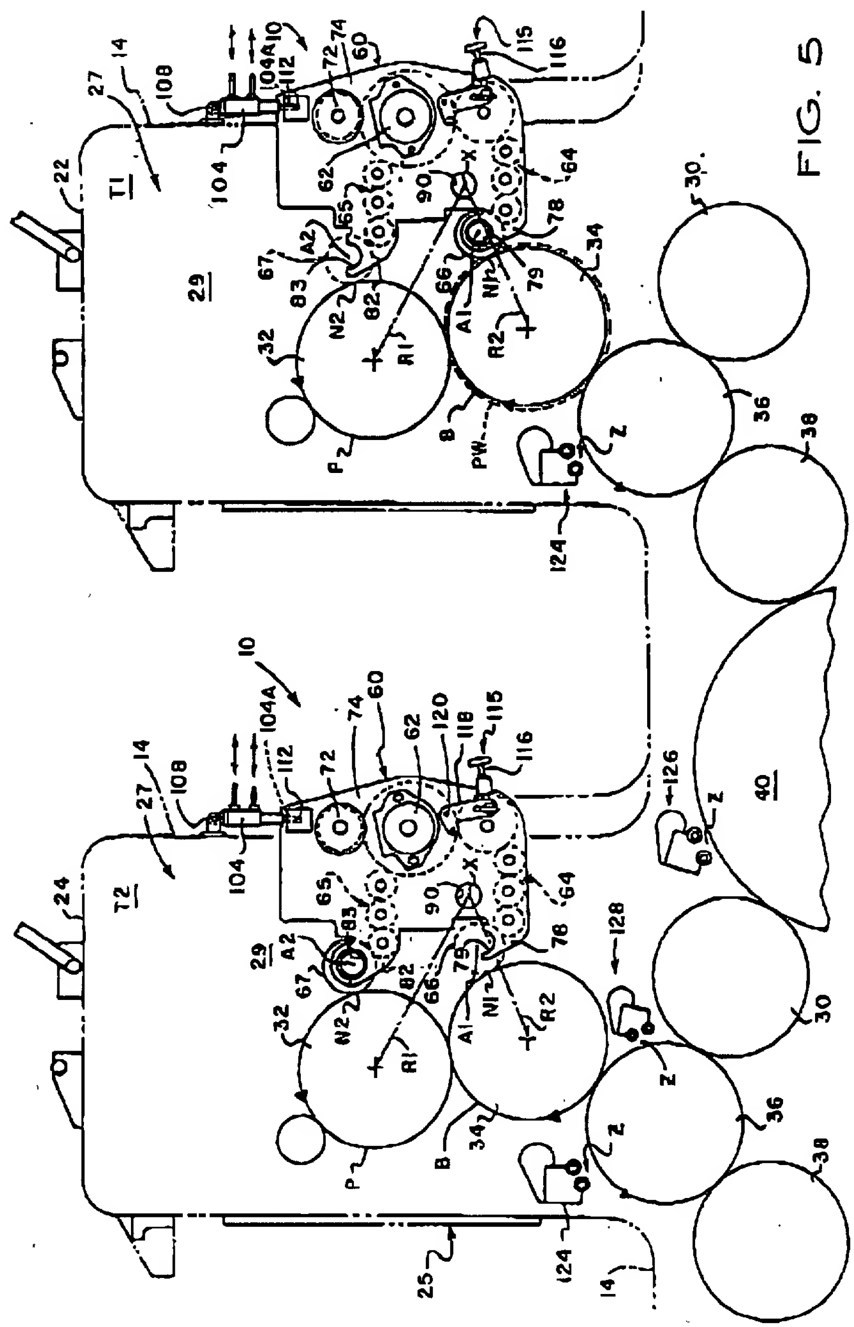


FIG. 5

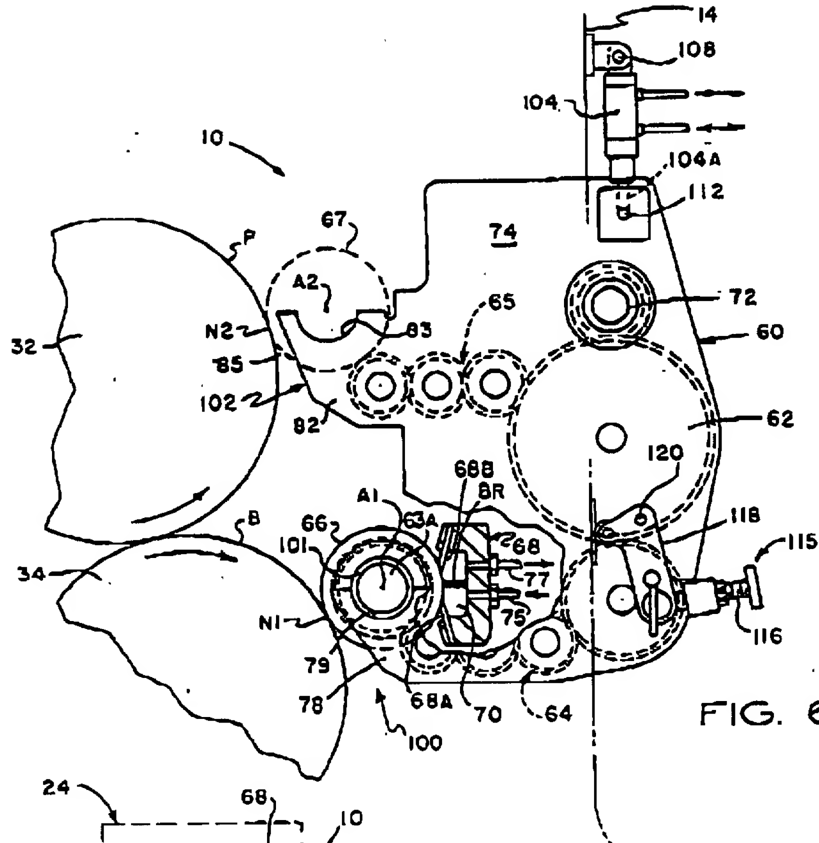


FIG. 6

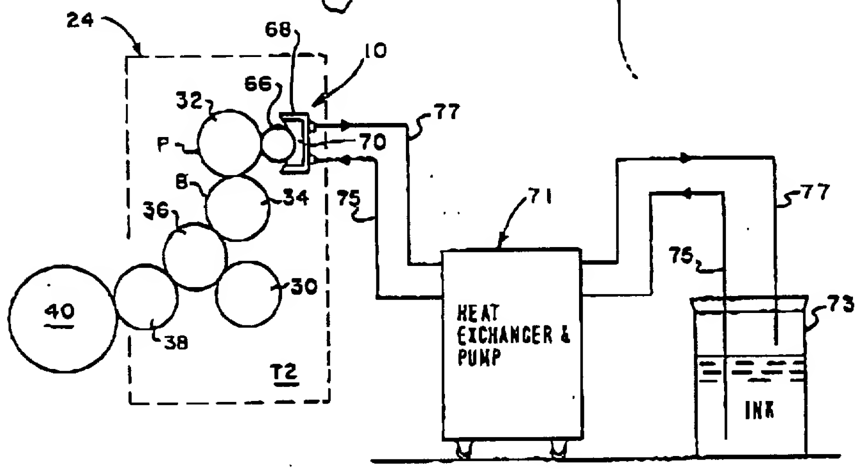


FIG. 7

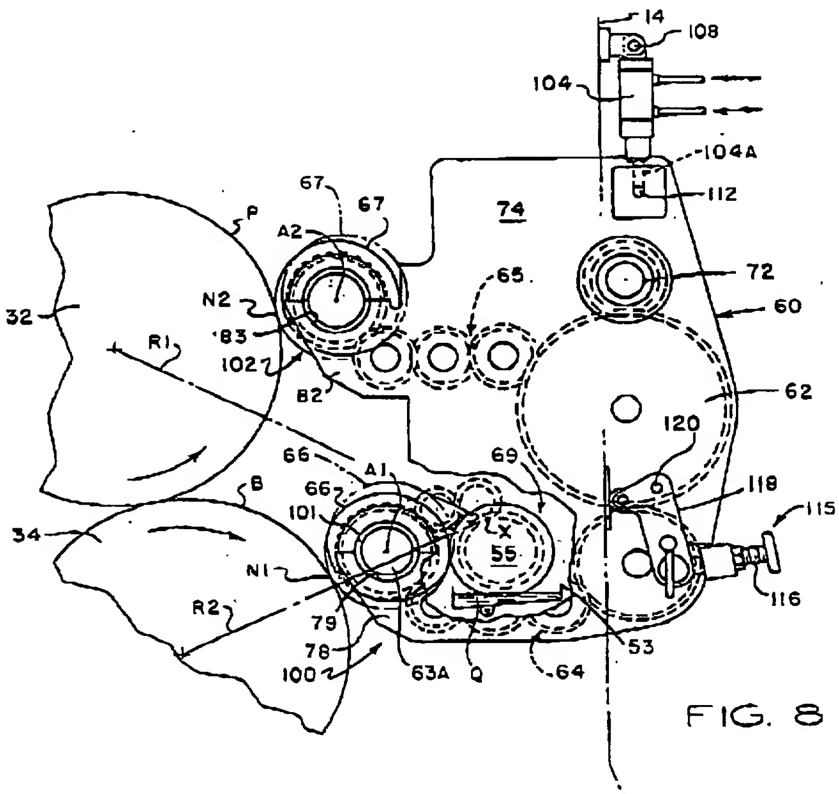

14
108
104
104A
112
74
67
67
A2
P
65
72
60
32
N2
83
R1
102
B2
62
120
66
A1
69
B
66
118
115
34
101
X
55
N1
116
R2
79
78
53
100
63A
Q
64

FIG. 8

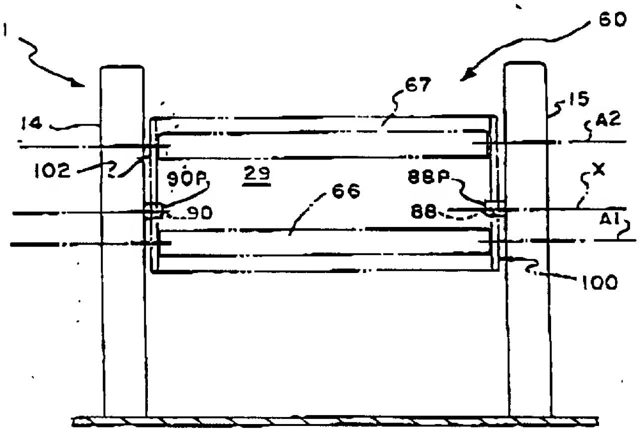

T1
60
67
14
15
A2
102
90P
29
88P
X
66
90
88
A1
100

FIG. 9

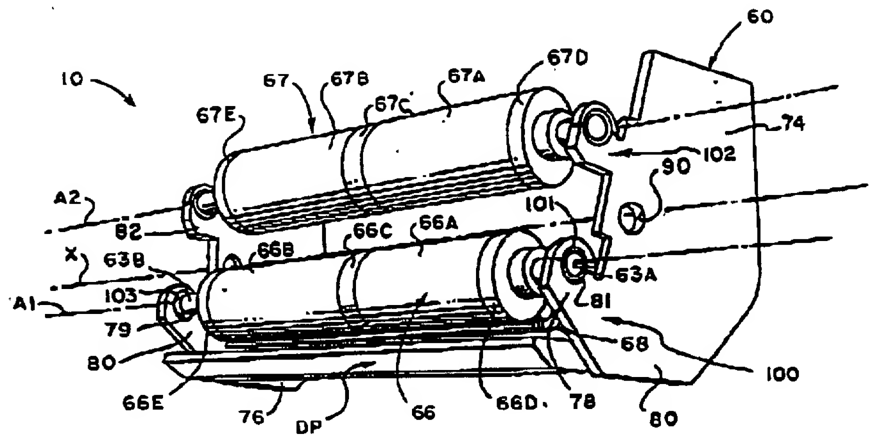


FIG. 10

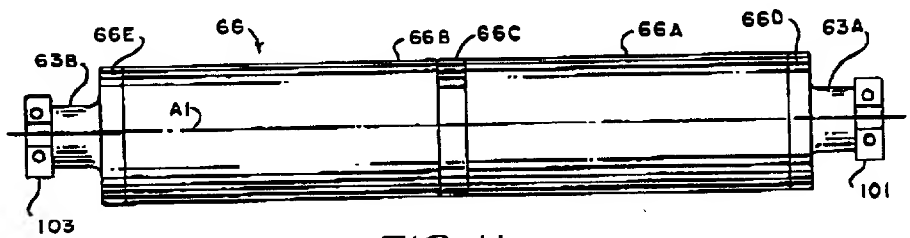


FIG. 11

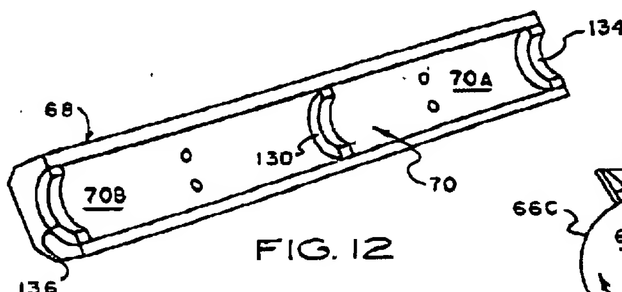


FIG. 12

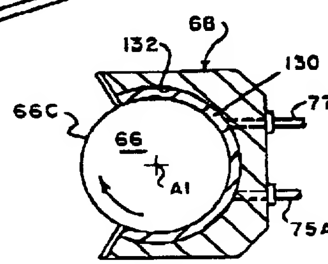
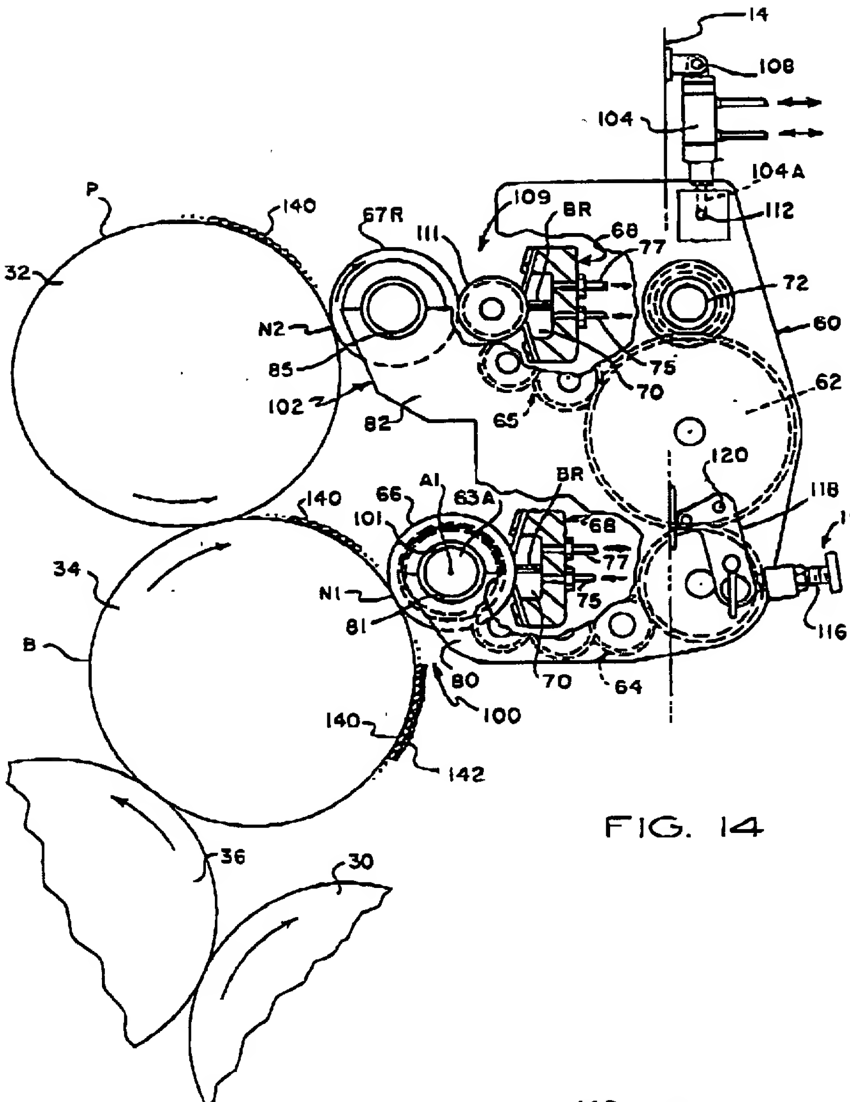


FIG. 13


14
108
104
104A
112
109
BR
68
77
72
60
P
140
67R
111
32
N2
85
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70
62
102
82
65
120
BR
140
66
A1
63A
68
118
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116
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81
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64
100
140
142
36
30

FIG. 14

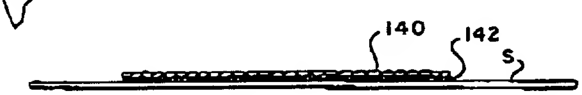
140
142
S

FIG. 15

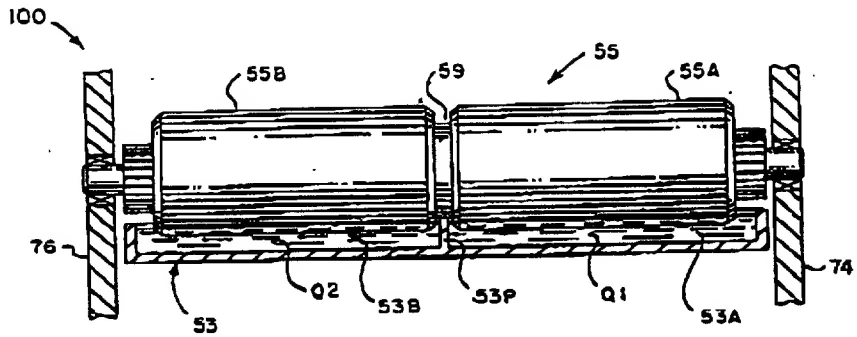
100
55B
59
55
55A
76
74
Q2
53B
53P
Q1
53
53A

FIG. 16

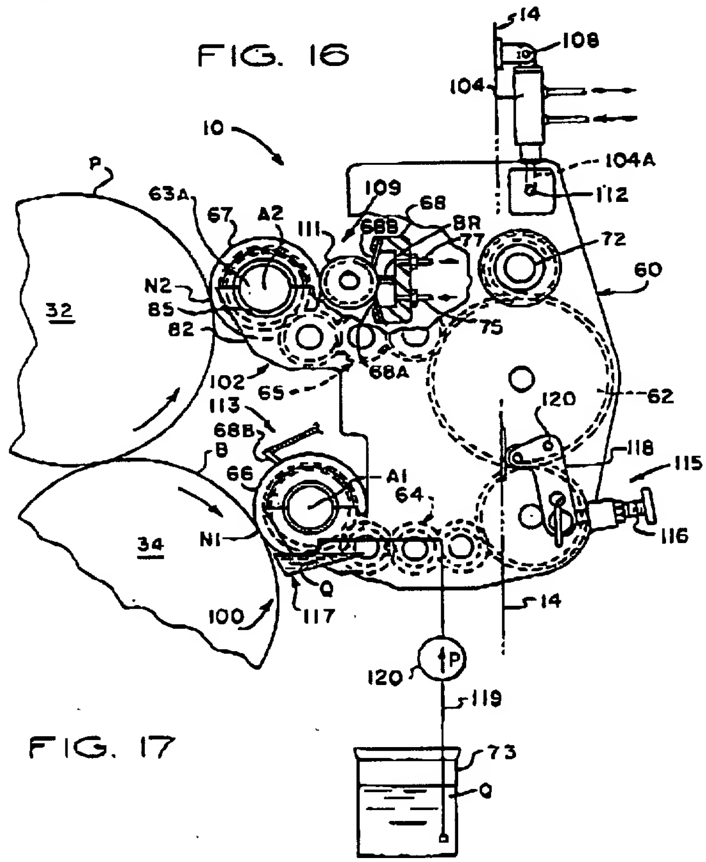
14
108
104
104A
112
10
P
63A
67
A2
109
68
111
68B
BR
77
72
60
N2
85
82
32
75
68A
102
65
113
120
62
68B
B
118
115
66
A1
64
116
34
N1
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FIG. 17

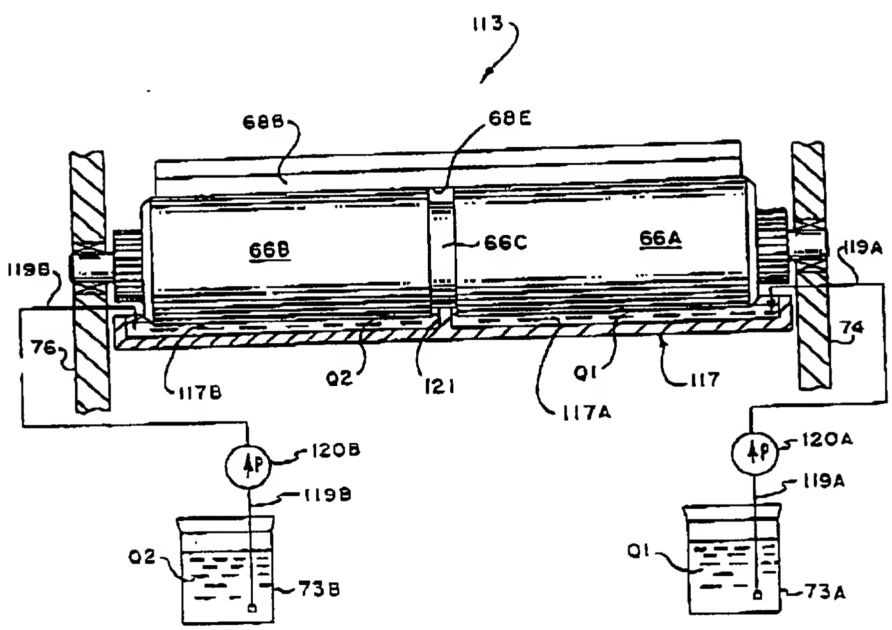
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FIG. 18

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United States Patent [19] | [11] Patent Number: 4,615,293
Jahn | [45] Date of Patent: Oct. 7, 1986

[54] **MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE**

[75] Inventor: Hans-Georg Jahn, Wiesenbach, Fed. Rep. of Germany

[73] Assignee: Heidelberger Druckmaschinen AG, Heidelberg, Fed. Rep. of Germany

[21] Appl. No.: 636,916

[22] Filed: Aug. 2, 1984

[30] **Foreign Application Priority Data**

Aug. 3, 1983 [DE] Fed. Rep. of Germany 3327993

[51] **Int. Cl.**^{4} B05C 1/02; B05C 11/10

[52] **U.S. Cl.** 118/46; 118/212; 118/221; 118/249; 118/255; 118/262

[58] **Field of Search** 118/46, 221, 222, 255, 118/262, 212, 249

[56] **References Cited**

U.S. PATENT DOCUMENTS

3,931,791	1/1976	Preuss et al.	118/236
4,399,767	8/1983	Simeth	118/46
4,446,814	5/1984	Abendroth et al.	118/46 X

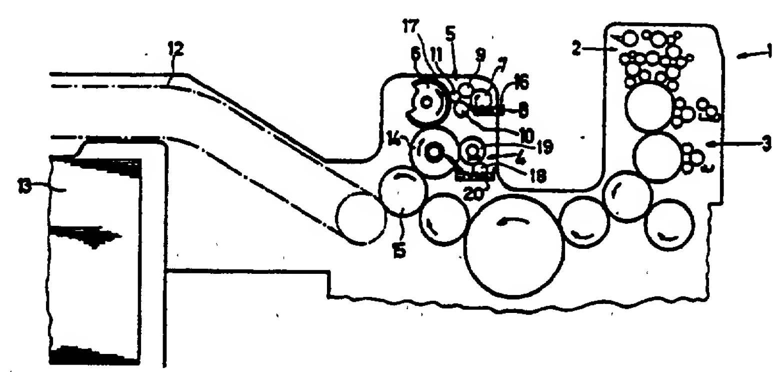
Primary Examiner—Evan K. Lawrence

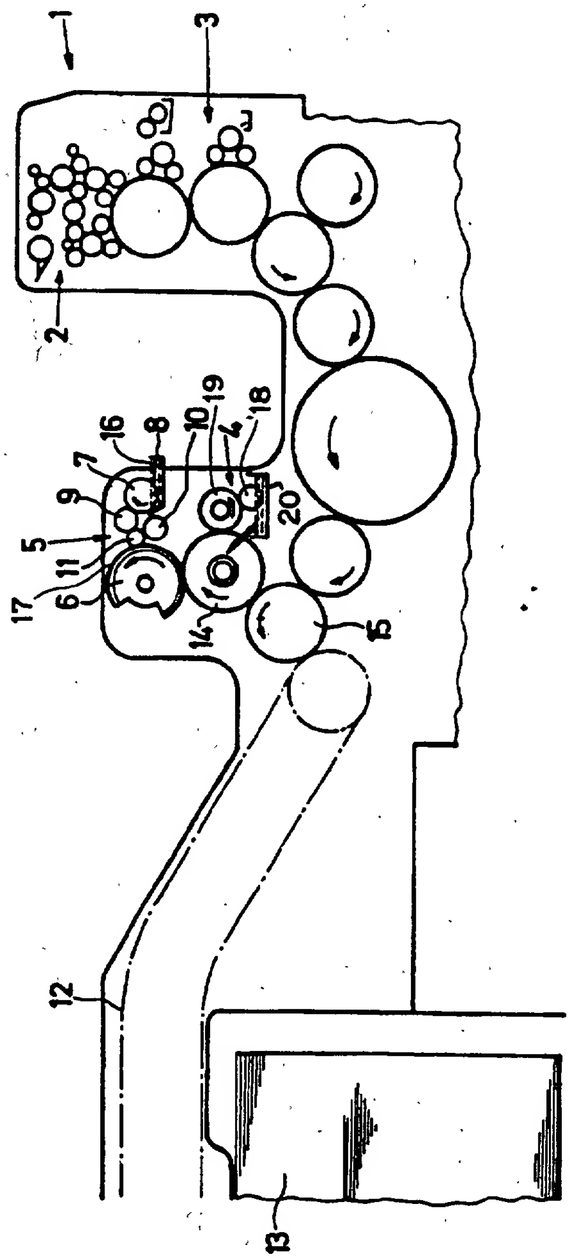
Attorney, Agent, or Firm—Herbert L. Lerner; Laurence A. Greenberg

[57] **ABSTRACT**

In a printing machine, a medium applicator disposed downstream of printing units of the machine, in travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

3 Claims, 1 Drawing Figure





MEDIUM-APPLYING DEVICE IN A PRINTING MACHINE

The invention relates to a medium applicator in a printing machine and, more particularly, to such a medium applicator which is disposed downstream of printing units of a printing machine, as viewed in travel direction through the machine of a sheet being printed therein, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium. A medium applicator of this general type has been described in my commonly owned co-pending application Ser. No. 626,732 filed July 2, 1984, now abandoned.

A lacquering or varnishing device in printing machines has become known heretofore from German Published Non-Prosecuted Application No. (DE-OS) 30 46 257. This device includes a lacquer storage tank or supply container and a scooping roller dipping into this tank. The lacquer taken up by the scooping roller is fed in metered fashion to an applicator roller. Two doctor rollers, by means of which a format-related lacquer feed occurs, can be set close to the scooping roller. A ductor blade applicable against the metering roller is also provided. This ductor blade serves to wipe superfluous lacquer from the metering roller and to return it to the supply container.

A specific disadvantage of this heretofore known device is that the lacquer is fed to the varnishing or lacquering cylinder via a distributor roller and an application roller. Because of the relatively long transport distance which the lacquer has to cover over many rollers until it reaches the printed sheet, the lacquer begins to set i.e. no quick-drying lacquers can be used. Due to this limitation to slowly drying lacquers, when the sheet is delivered the reverse side or back of the next following sheet will smear the lacquer and thus paste the sheets together. Consequently, no full sheet piles can be set up, because the pile weight which is built up at the delivery end and which applies a load to the individual sheets also limits the lacquer layer thickness.

In the device described in German Pat. No. 23 45 183 for applying a medium there are provided a dipping roller, a metering roller, an applicator roller, a back-pressure cylinder, a form cylinder and another applicator roller. The two applicator rollers, the dipping roller and the metering roller are combined into a common structural unit. Within this structural unit, either the dipping roller with the form cylinder or the first applicator roller with the form cylinder or the second applicator roller with the back-pressure cylinder can cooperate.

A disadvantage of this last-mentioned construction is that the lacquer must first be fed to the printed material via the form cylinder. The platen mounted on the clamping device at the form cylinder forms a channel in which the lacquer accumulates after a given operating time. This lacquer-accumulation results in an irregular lacquer application due to dripping of the lacquer down onto the printed material.

German Pat. No. 20 20 584 is based upon a device for avoiding smearing of the ink due to lacquering. By means of a lacquering unit, the lacquer is applied to a printing-unit cylinder. This printing-unit cylinder, which has the same diameter as that of the cylinders of the preceding printing units, transfers the lacquer to the printed material. The disadvantages referred to hereinbefore are also applicable to this construction and require additionally, time-consuming cleaning work to be performed on the rollers. Moreover, the construction of the printing unit is complicated by having to attach the lacquering unit to the rubber of blanket cylinder.

A further disadvantage of the state of art as exemplified by the references cited hereinbefore, is that, due to the directions of rotation of the rollers, the format-related wiping by the ductor blade cannot be observed, thus making impossible a precise wiping or removal of the superfluous lacquer material.

It is an object of the invention of the instant application to provided a further improvement over the construction in my aforementioned co-pending application in the form of a supplemental medium-applying device which is suitable especially for coating or lacquering surfaces which are interrupted or spaced from one another and, furthermore, to provide a supplementary medium applicator or lacquering unit for applying coatings or for lacquering with layers of any selected thickness.

With the foregoing and other objects in view, there is provided, in accordance with the invention, in a printing machine, a medium-applicator disposed downstream of printing units of the machine, in the travel direction through the machine of a sheet being printed, the medium applicator having an assembly formed of a first roller for taking up medium from a supply container, a second roller for metering a quantity of the medium to be applied, and a third roller for transferring the medium, the third roller having a continuous cylindrical surface with a rubber lining disposed thereon for directly applying the medium onto the sheet, the three rollers being in constant meshing engagement with a sheet-transfer cylinder during application of the medium, the medium applicator further comprising a plate cylinder having a cylindrical surface interrupted by a transverse channel and carrying a flexible relief plate having raised surfaces thereon, and another assembly of rollers for supplying medium from another supply container to the raised surfaces of the flexible relief plate, the plate cylinder being in operative engagement with the third roller.

In this lacquering device or medium application, it is possible to apply medium or lacquer by means of a flexible relief or letterpress plate which is disposed on a plate cylinder. Fields or sections of the most varied size and shape are provided on this relief plate in order to perform the desired application of medium or lacquering of areas which are interrupted or spaced from one another.

In accordance with a further feature of the invention, the first, second and third rollers and the medium supply container associated therewith form a first-medium applying device, and the plate cylinder, the other assembly of rollers and the other supply container form a supplementary medium-applying device, and means are included for operating the first medium-applying device simultaneously with the supplementary medium-applying device.

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US005107790A

United States Patent [19]

Sliker et al.

[11] Patent Number: 5,107,790

[45] Date of Patent: Apr. 28, 1992

[54] **TWO HEADED COATER**

[75] Inventors: Larry J. Sliker, Livonia; Robert S. Conklin, Rochester, both of N.Y.

[73] Assignee: Rapidac Machine Corp., Rochester, N.Y.

[21] Appl. No.: 463,115

[22] Filed: Jan. 11, 1990

[51] Int. Cl.^{5} B05C 1/08; B05C 11/00

[52] U.S. Cl. 118/674; 118/46; 118/212; 118/249; 118/255; 118/258; 118/262

[58] Field of Search .... 118/674, 46, 249, 255, 118/258, 262, DIG. 1; 101/247, 329, 352

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4,569,306	2/1986	Ito et al.	118/46
4,615,293	10/1986	Jahn	118/46
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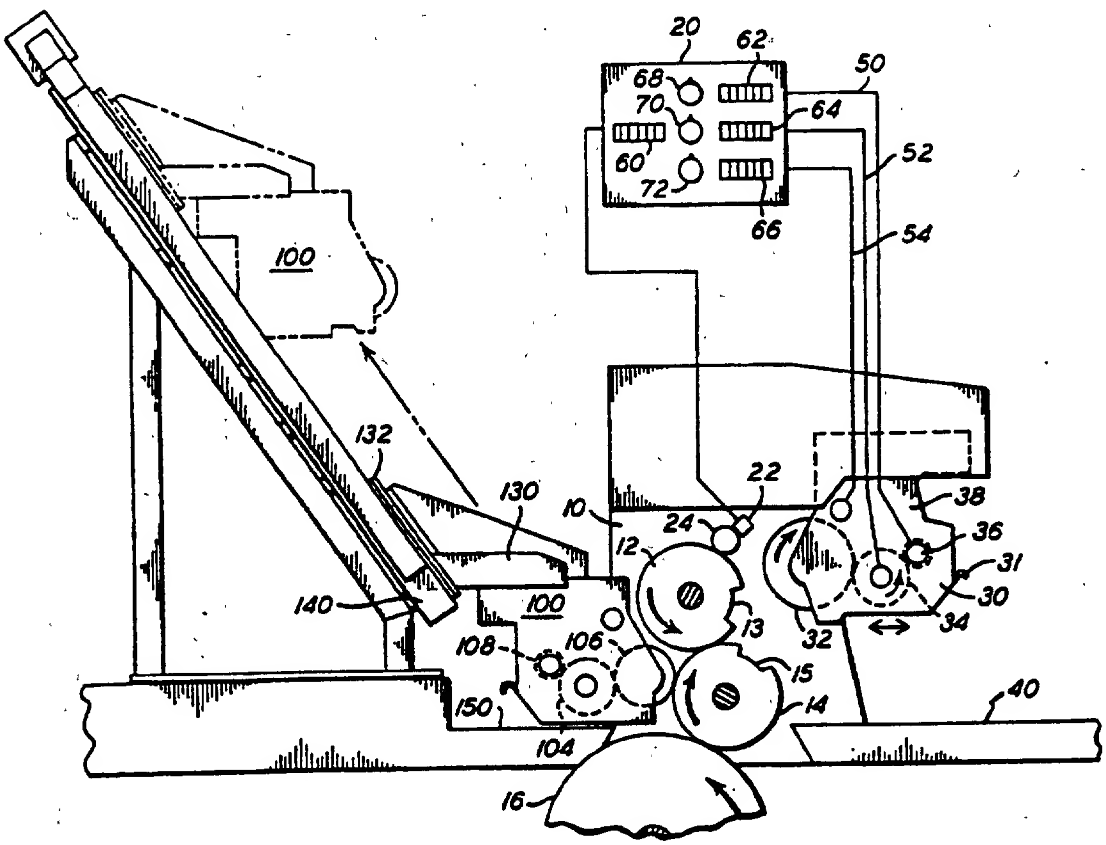
Primary Examiner—Michael G. Wityshyn

Attorney, Agent, or Firm—Cumpston & Shaw

[57] **ABSTRACT**

Coating apparatus for applying continuous or spot coatings to an image printed surface includes a plate cylinder; a blanket cylinder for transferring a coating material from the plate cylinder to the copies; a blanket coating roller for transferring a continuous layer of coating material to the blanket cylinder; a plate coating roller for selectively applying spot coating material to the plate cylinder; a first retractor for moving the blanket coating roller laterally into and out of transferring engagement with the blanket cylinder; and a second retractor for moving the plate coating roller into and out of transferring engagement with the plate cylinder.

14 Claims, 3 Drawing Sheets



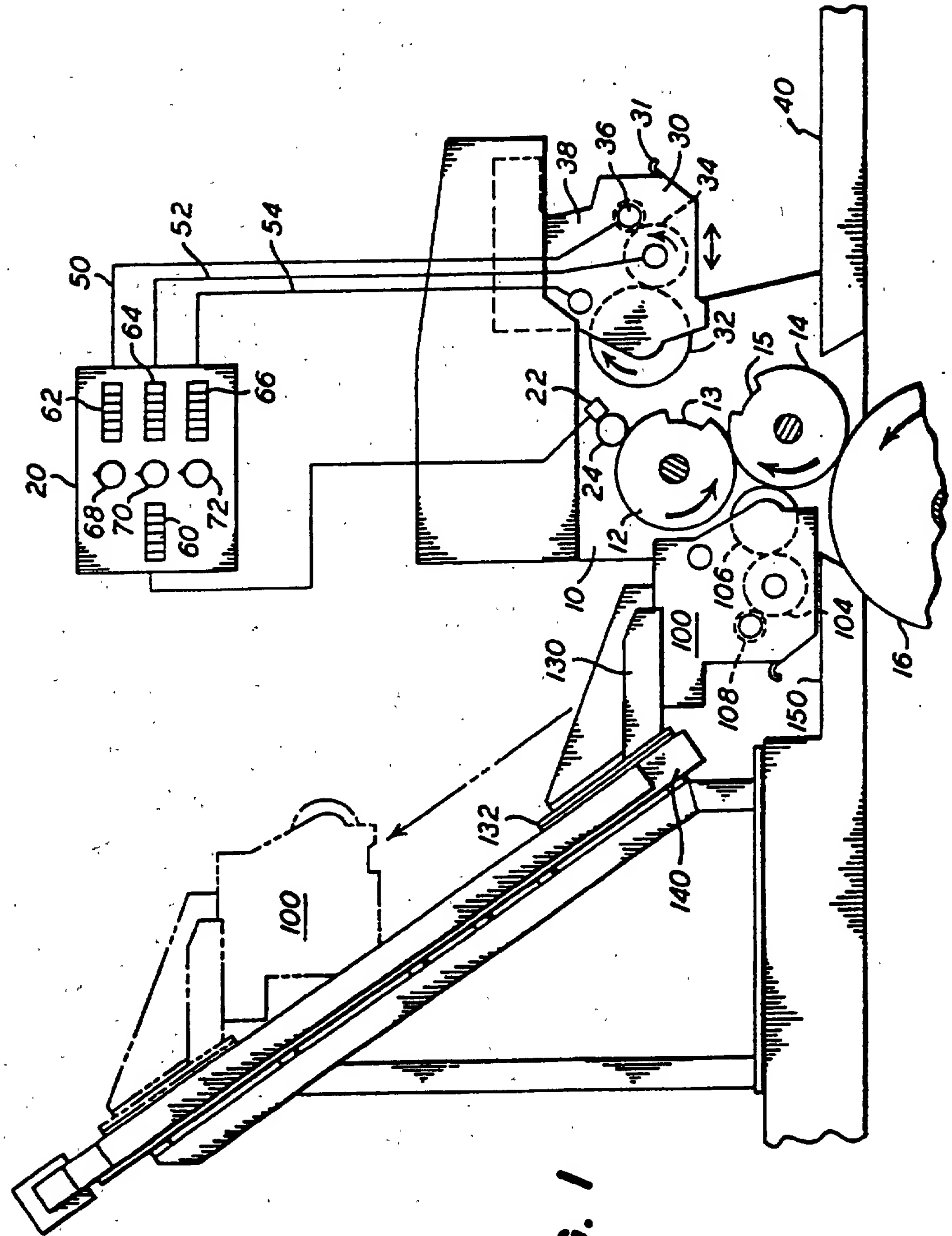

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FIG. 1

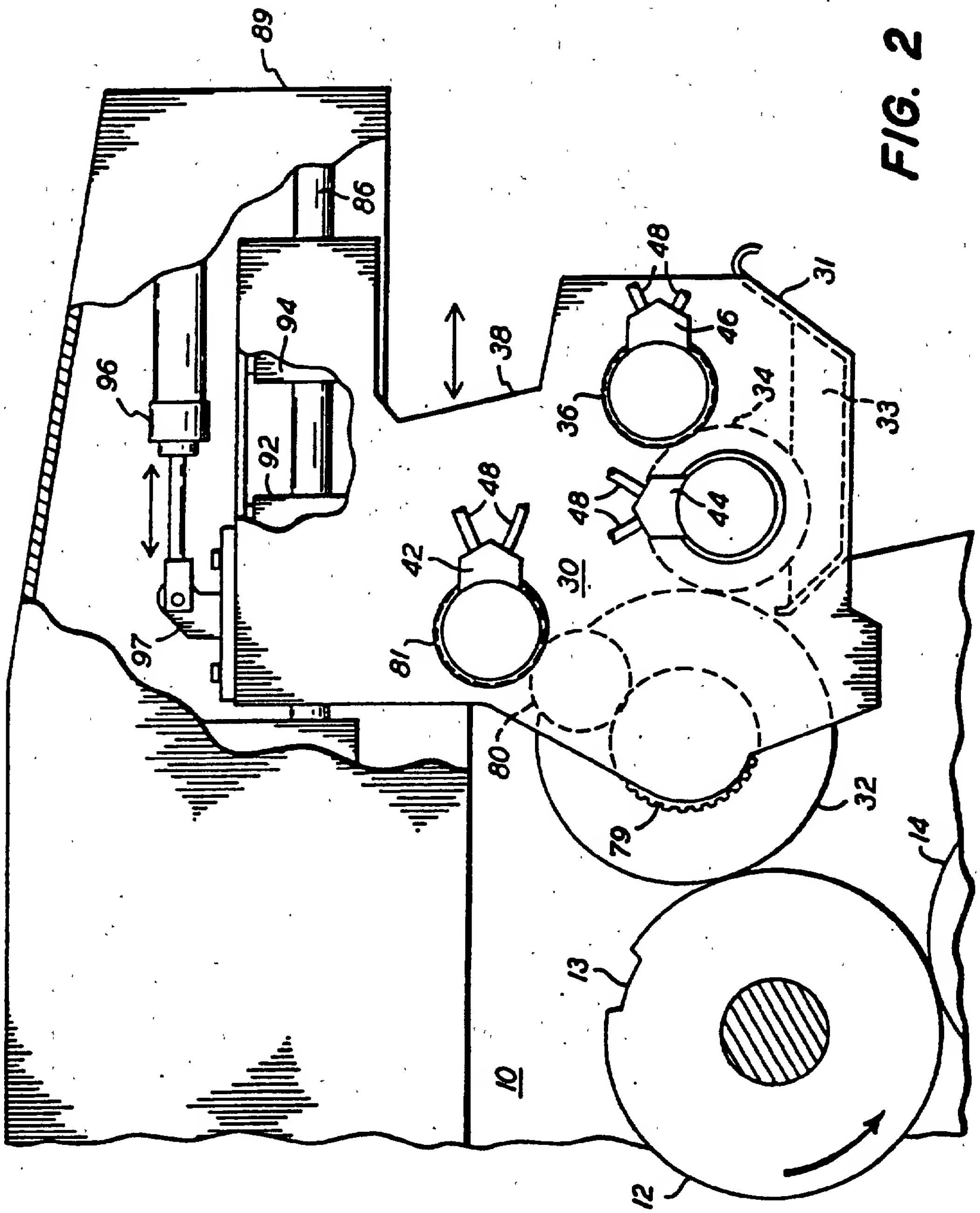

FIG. 2

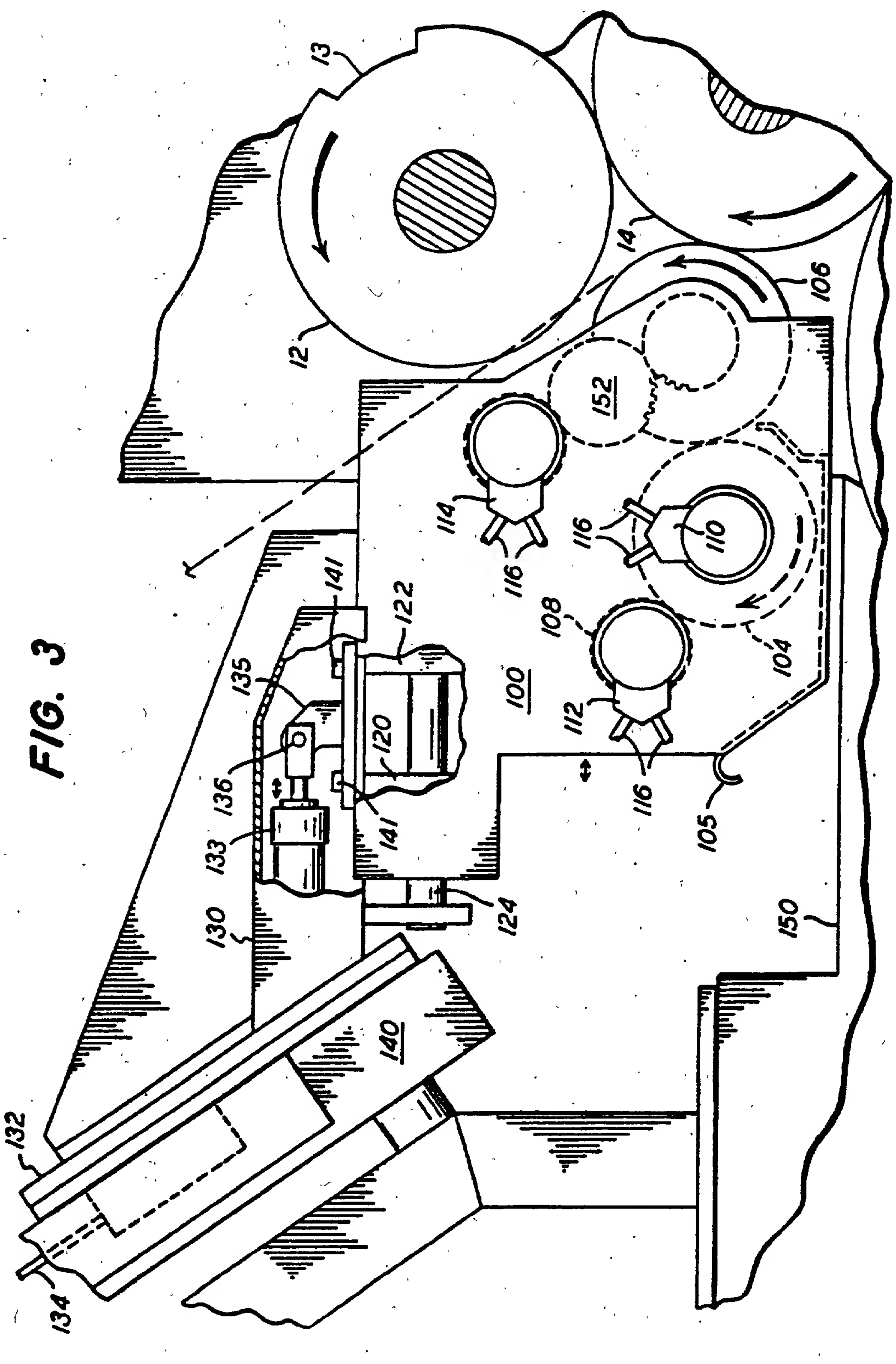
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FIG. 3

TWO HEADED COATER

This invention relates in general to coating apparatus for printing presses, and more particularly to a dual headed coater adapted to provide overall or spot coating on a printed sheet or web as a final or near final step in the printing process.

The advantages of coating printed sheets are well known, and much effort has been expended in providing satisfactory apparatus for carrying out the coating process. Among the many patents relating to coating apparatus are U.S. Pat. Nos. 4,615,293, 4,569,306, 4,685,414, 4,446,814, 4,421,027, 4,399,767, 4,397,237, 4,308,796, 4,270,483, and 3,931,791.

For flexibility and to reduce costs, printing presses are often assembled from a plurality of substantially identical printing units, the number of units used being determined by the number of colors to be printed. Each printing unit applies a different color ink to the sheet or web to form the printed image. It is advantageous, to reduce costs, and maintain flexibility in adapting the press to different jobs, to provide coating apparatus that may be selectively engaged with the plate or blanket cylinders of an existing printing unit to carry out the coating operation and disengaged so that the printing unit can be used for its normal purpose or allowed to idle when coating is not required.

Among the patents mentioned above, Jahn U.S. Pat. No. 4,615,293 shows a medium applicator for a printing machine. The medium applicator (coater) is disposed downstream of the printing units of the machine, and includes two applicator rollers, one contacting the roller that would function as the plate roller in a conventional printing unit and the other contacting the blanket cylinder. The coating rollers are disposed on the upstream side of the plate and blanket cylinders respectively of the coating assembly.

Although the coating apparatus described in the Jahn patent is theoretically capable of carrying out the spot and blanket coating operations as described, in practice, the arrangement shown in the Jahn patent is impractical, and would be of little use in a large scale printing application.

Printers can produce high volumes of printed material rapidly through the use of modern printing presses. The presses are extremely expensive, and the amount of time required to reconfigure the press from one job to another is non-productive, and costly. Accordingly, there is a need for presses and associated coating apparatus that minimize the time required to clean up from one run, and set up and commence the next run. Although versatile coaters that can apply spot and blanket coatings are desirable, ordinarily only one coater at a time is actually in operation. Where consecutive jobs require the same sort of coating, particularly blanket coating, it may not be necessary to clean up the coater between jobs. However, the coating lacquers cannot be allowed to dry on the rollers, and therefore, especially when switching from blanket to spot coating or vice-versa, or if there is a wait between jobs, it is necessary to clean up the coaters after each job is completed. In addition, cleanup is necessary when switching between different coating compositions, such as aqueous and u-v coatings. Such coatings are incompatible, and the coaters must be cleaned between applications of such different coatings.

Modern high speed printing presses are dangerous to work around in ordinary circumstances, and are particularly dangerous when operating at full speed. It would be virtually impossible to clean the prior art coaters such as the coater shown in the Jahn patent while the press is operating, and especially difficult for example to clean the blanket coater while printing spot coatings on a subsequent job.

Accordingly, it is an object of this invention to provide coating apparatus for applying continuous or spot coatings to an image printed surface comprising: a plate cylinder; a blanket cylinder for transferring a coating material from the plate cylinder to the copies; a blanket coating roller for transferring a continuous layer of coating material to the blanket cylinder; a plate coating roller for selectively applying spot coating material to the plate cylinder; first retracting means for moving the blanket coating roller laterally into and out of transferring engagement with the blanket cylinder; and second retracting means for moving the plate coating roller into and out of transferring engagement with the plate cylinder.

It is another object of this invention to provide coating apparatus of the type described and further including tachometer or other means responsive to the rotation of the plate and blanket cylinders for providing speed signals proportional to the press speed and control means responsive to the speed signals for controlling the speed of the plate and blanket coating rollers.

It is another object of this invention to provide drive means for the plate and blanket coating rollers, and independent controllers for each of the drive means permitting the relative speeds of the plate and blanket coating rollers and plate and blanket cylinders respectively, to be continuously controlled to adjust the shear at the nip between the rollers and the cylinders at various press speeds for enhancing the coating operation.

It is still another object of this invention to provide a retracting assembly for moving one of the plate and blanket coating rollers horizontally into and out of engagement with one of the plate and blanket cylinders, and for lifting the coating roller assembly away from the cylinder for easy access during cleaning.

It is still another object of this invention to provide means for translating the other coating roller into and out of engagement with the other cylinder, the out of engagement position adapted to permit cleaning of the roller and associated apparatus.

It is a still further object of this invention to provide control means responsive to sensing tachometers or other means providing signals proportioned to press speed coupled to the plate and blanket cylinders for controlling the rotation of the coating rollers and associated pick up and metering rollers for controlling the amount of coating material applied to the printed page.

It is a still further object of this invention to provide control means for incrementally adjusting the relative speed of the pickup, metering, and coating rollers relative to the speed of the plate and blanket cylinders.

It is a feature of this invention that coating rollers can be employed, because of the placement thereof on opposite sides of the press unit, that are larger in diameter than those utilized in prior art coaters. The use of large diameter coating rollers reduces the speed of rotation of the rollers, and thereby the tendency of the rollers to sling coating material off the surface by centrifugal force. This is especially advantageous in pattern or spotting coating operations, where the surface speeds of

the applicator roller and plate cylinder must be the same. The use of larger rollers reduces the centrifugal force produced at the surface of the applicator roller, thus greatly reducing the slinging or misting of coating material, when the present invention is employed. Slinging or misting of coating material greatly increases the difficulty of cleanup after a coating operation.

While the novel aspects of the invention are set forth with particularity in the appended claims, the invention itself, together with further objects and advantages thereof, may be more readily understood by reference to the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a side elevation of a two headed coater in accordance with this invention;

FIG. 2 is an enlarged segmental side elevation of the plate coating assembly of the two headed coater of FIG. 1; and

FIG. 3 is a segmental side elevation of the blanket coating assembly of the two headed coater of FIG. 1.

Referring now to FIG. 1, a simplified view of a printing unit, preferably the last unit, of a multi-stage offset printing press is illustrated with the coating apparatus of the invention operatively associated therewith. The coating apparatus of this invention is specially adapted to allow it to be retrofitted to a variety of printing units, either during manufacture, or after a press has been installed in a print shop. The damping and inking systems employed in a conventional printing unit are not shown. They may be omitted if the coating unit is designed solely for coating, removed, or simply disengaged or not used in a printing unit retrofitted for coating in accordance with this invention. The unique construction of the two headed coater of this invention permits the coating rollers to be moved into contact with the plate cylinder and blanket cylinder of the converted printing unit, and to be withdrawn to accessible positions for cleaning when not in use.

Printing unit 10 includes a plate cylinder 12 and a counter rotating blanket cylinder 14. As used herein, plate and blanket cylinder refer to the assemblies including plates and blankets, and associated clamps and the like, that are disposed in recesses 13 and 15 shown schematically in the drawing for simplicity. Blanket cylinder 14 contacts an impression cylinder 16 under some pressure and the printed sheet is normally passed through the nip between the blanket and the impression cylinders in a manner well understood by those skilled in the art. Conventional drive means, including cylinder gear wheels, a main driver motor and associated controls, not shown, synchronize the rotation of the plate cylinder, blanket cylinder, and impression cylinder, with the rest of the press.

A controller 20 continuously monitors the press speed through the use of a speed sensor, such as tachometer 22, which may be an optical encoder having a wheel 24 arranged to bear against the plate cylinder (or the blanket cylinder if it is more accessible) for providing a continuous speed signal to controller 20. As used herein, the term tachometer is intended to encompass any device that provides a signal from which the relative speed of the press may be determined. Many presses incorporate such devices internally, and the outputs from internal tachometers of whatever sort are often suitable as speed signals for the coaters of the present invention.

Turning now to the spot coater assembly of the invention, the assembly 30 includes a coating roller 32, a pick up roller 34, and a metering roller 36, all journalled in a conventional fashion in a laterally translatable frame 38 as will be more fully described in connection with FIG. 2.

Referring to FIG. 2, pickup roller 34 is adapted to be at least partially immersed in a container 31 of coating material, such as lacquer 33. The container is omitted from FIG. 1 of the drawing, so as not to obscure the remaining elements. Pick up roller 34 rotates counter clockwise, and metering roller 36, by virtue of the spacing at the nip and the relative speed thereof with respect to the pickup roller, controls the amount of coating material transferred to the coating roller 32 from pickup roller 34. Spot coating assembly 30 is shown in its retracted position in FIG. 1. In this position the assembly is accessible for cleaning, even while the press is running. To this end, a work space is provided adjacent to the coating assembly on a platform 40 on which an operator may stand, to gain access to the spot coating assembly for service and cleaning.

Referring now to FIG. 2, the spot coater 30 is shown in its operating position with coating roller 32 engaging plate cylinder 12. Each of the rollers 32, 34, and 36 of the spot coating assembly 30 is driven by a separate hydraulic motor 42, 44 and 46 respectively. Conventional hydraulic lines 48 convey pressurized hydraulic fluid from a pump and controller valves to the motors and provide for a return to the pump (not shown). The control valves are connected to controller 20. A speed sensor is provided on each of hydraulic motors 42, 44 and 46. The speed sensors are connected to controller 20 via sensing lines 50, 52 and 54. Controller 20 preferably includes conventional displays such as digital for the press speed 60, metering roller speed 62, pickup roller speed 64, and plate coating roller speed 66. The speed of each of the metering, pickup and coating rollers is adjustable by means of controls 68, 70 and 72 respectively that are coupled to the controller valves. In addition, controller 20 is responsive to the press speed as sensed by tachometer 22 for correspondingly increasing or decreasing the speeds of the motors driving pickup, metering and coating rollers, so as to maintain synchronization with the press. It will be understood that synchronization does not necessarily mean that all of the rollers are driven in such a manner as to provide zero slip (relative speed) at the nips, but rather that the desired conditions, which may include relative shear at the nips, are maintained as the press speed is increased. In accordance with a presently preferred embodiment of the invention, the relative speeds of the rollers are set while the press is running at a low speed, and the controller 20 adjusts the speeds of the motors driving the pickup, metering and coating rollers, to maintain the same relative speed as the press speed increases. By adjusting controls 68, 70 and 72, the relative speeds may be fine tuned at any press speed.

As shown in FIG. 2, pickup roller 34 and metering roller 36 are driven directly by hydraulic motors 44 and 46 respectively, while coating roller 32 is driven indirectly by the motor via gear wheels 79, 80, and 81. Those skilled in the art will recognize that the precise manner in which the rollers are driven may be changed to accommodate different arrangements, the particular arrangement shown in FIG. 2 therefore representing only an example of a presently preferred embodiment of the invention.

Frame 38 of spot coating assembly 30 is laterally translatable on horizontally disposed traverse rod 86 rigidly mounted in a support 89, which is attached to coating unit 10. Frame 38 is attached to bearing blocks 92 and 94, that slidably engage rod 86. Linear hydraulic actuator 96 is attached to bracket 97 of frame 38 at one end, and to support 89 at the other, for laterally translating coating assembly 30 into and out of engagement with plate cylinder 12 as illustrated in FIGS. 1 and 2 respectively.

While plate coating assembly 30 is supported on a cantilevered arm of support 89 in accordance with a presently preferred embodiment of this invention, other functionally equivalent arrangements might be useful on printing stages having different configurations from the ones shown.

Referring now to FIGS. 1 and 3, the blanket coating assembly 100 of the invention is shown. Like the spot coating assembly, blanket coating assembly 100 includes a pickup roller 104 extending into a tray 105 adapted to contain a supply of coating liquid, such as lacquer or the like. Pickup roller 104 rotates clockwise and transfers the coating liquid onto blanket coating roller 106 in an amount determined by metering roller 108. The pickup, metering and blanket rollers are driven by hydraulic motors 110, 112 and 114 respectively, either directly or via gear wheels in like manner to the plate coater already described. The motors are supplied with pressurized hydraulic fluid through lines 116 in the manner already described in connection with the plate coating assembly 30. Similarly, speed sensors, not shown, are operatively engaged with each of the rollers or the motors to provide feedback signals representing the rotational speed of the rollers.

Blanket coating assembly 100 is carried by bearing blocks 120 and 122 slidably mounted on traverse rod 124, which is rigidly attached to cantilever arm 130 of carriage 132. Linear hydraulic actuator 133 has one end 136 coupled to a bracket 138, which is attached to blanket coating assembly 100 by bolts 141, or in other convenient fashion. Operation of actuator 134 translates plate coating assembly 100 into and out of engagement with blanket cylinder 14. Carriage 132 is attached to lifting cable 134, which extends up track 140 to conventional lifting means (not shown) to permit blanket coating assembly 100 to be raised to the position shown in phantom in FIG. 1, for cleaning or other servicing. Conventional means, such as a linear hydraulic actuator attached to cable 134, are employed to pull carriage 132 to the raised position. It will be appreciated by reference to FIG. 3, that it is necessary to laterally translate assembly 100 to the left before raising the carriage, in order that blanket coating roller 106 will clear the periphery of plate cylinder 12, as the carriage is raised.

When the carriage is raised, space is created on platform 150 for an operator to service blanket coating assembly 100.

It will be understood that a second controller unit similar to controller 20 is provided for controlling the rotation of pickup roller 104, metering roller 108 and coating roller 106. This controller is not shown in the drawings, because the connections thereto would obscure the remaining elements of the invention and are in any event identical to those already shown and described in connection with the plate coater. As was the case in connection with spot coater 30, hydraulic motor 14 drives coating roller 106 through an intermediate gear 152 in conventional fashion.

While the invention has been described in connection with a presently preferred embodiment thereof, those skilled in the art will recognize that certain modifications and changes may be made therein without departing from the true spirit and scope of the invention, which accordingly is intended to be defined solely by the appended claims.

What is claimed is:

1. Coating apparatus for applying continuous or spot coatings to a plate cylinder and a blanket cylinder of a printing press in which the plate cylinder is disposed generally above the blanket cylinder and arranged so that either of a plate coater and a blanket coater can be serviced while the other coater is operating;

a retractable blanket coater disposed on one side of the plate and blanket cylinders for transferring a layer of coating material to the blanket cylinder;

a retractable plate coater disposed on a side of the plate and blanket cylinders opposite the blanket coating roller for applying coating material to said plate cylinder;

blanket coater retracting means for moving said blanket coater between an operating position in contact with said blanket cylinder and a service position out of contact with the blanket cylinder;

plate coater retracting means for moving said plate coater between an operating position in contact with said plate cylinder and a service position out of contact with the plate cylinder; and

lifting means for lifting the blanket coater away from the blanket cylinder so that when one of the plate and blanket coaters is operating and the other is out of contact, the out of contact coater may be serviced without interfering with the operation of the operating one of the plate and blanket coaters.

2. The coating apparatus of claim 1 in which the plate coater comprises a plate coating roller and in which the blanket coater comprises a blanket coating roller and a plate coater motor for rotating said plate coating roller; a blanket coater motor for rotating the blanket coating roller; and also comprising

speed sensor means for providing a press speed signal; and

control means responsive to the press speed signal for controlling the speed of the plate coater motor and the blanket coater motor.

3. The coating apparatus of claim 2 wherein sid speed sensor means comprises tachometer means coupled to one of the plate cylinder and the blanket cylinder.

4. The coating apparatus of claim 2 further comprising a pickup roller for transferring a coating liquid to the plate coating roller and a metering roller for controlling the amount of coating liquid transferred to the plate coating roller.

5. The coating apparatus of claim 4 further comprising motor means for rotating the pickup roller and the metering roller.

6. The coating apparatus of claim 5 wherein said control means is connected to sid motor means for varying the speed of the pickup roller and the metering roller in response to the press speed signal.

7. The coating apparatus of claim 2 further comprising a pickup roller for transferring a coating liquid to the blanket coating roller and a metering roller for controlling the amount of coating liquid transferred to the blanket coating roller.

8. The coating apparatus of claim 7 further comprising motor means for rotating the pickup roller and the metering roller.

9. The coating apparatus of claim 7 wherein said control means is connected to said motor means for varying the speed of the pickup roller and the metering roller in response to the press speed signal.

10. Coating apparatus for a printing press including a plate cylinder and a blanket cylinder, comprising:

a coating assembly including a coating roller engaging one of the plate cylinder and the blanket cylinder, a pickup roller engaging the coating roller, and a metering roller; drive motors coupled to each of the coating roller, the pick up roller and the metering roller; and

speed sensor means coupled to a printing press and responsive to the speed of the press and coupled to the drive motors for independently controlling the rotational speeds of at least two of the coating roller, the pickup roller and the metering roller.

11. The coating apparatus of claim 10 in which the speed sensor means comprises a tachometer coupled to the press.

12. The coating apparatus of claim 11 in which the tachometer is coupled to the plate cylinder of the press.

13. The coating apparatus of claim 10 comprising individual speed controllers for each of the drive motors, so that the relative speed at the nip between any two adjacent rollers can be adjusted.

14. The coating apparatus of claim 13 further comprising means for maintaining the relative speeds of the pickup, metering and coating rollers as the press speed varies.

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【発明の名称】　あらゆる輪転オフセット印刷機の第１の印刷ユニット又はそれに続くいずれかの印刷ユニットの湿し装置側から版胴及びブランケット胴上で同時に作動可能な引込み式印刷／コーティングユニット

【請求項の数】　16

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【発明の名称】　あらゆる輪転オフセット印刷機の第１の印刷ユニット又はそれに続くいずれかの印刷ユニットの湿し装置側から版胴及びブランケット胴上で同時に作動可能な引込み式印刷／コーティングユニット

【特許請求の範囲】

【請求項１】　第１及び第２の印刷ユニットを含み、この第１の印刷ユニットがフレキソ印刷版、ブランケット、圧胴及びフレキソ印刷版及び／又はブランケットに対して水性又はフレキソ印刷用インキ又はコーティング材料を塗布するためのインキング／コーティングアプリケータ手段を有しているタイプの輪転オフセット印刷機内で印刷するための方法において、

－　フレキソ印刷版に対して水性又はフレキソ印刷用インキ又はコーティング材料の第１のスポット又は全体的コーティングを施す段階；

－　フレキソ印刷版からブランケットまで水性又はフレキソ印刷用インキ又はコーティング材料を移送する段階；

－　ブランケットに対する水性又はフレキソ印刷用インキの第２のスポット又は全体的フィルム又はコーティング材料層を塗布する段階；

－　下地材がブランケットと圧胴の間のニップを通して移送されるにつれて、この下地材に対しブランケットからインキ又はコーティング材料を移送する段階；及び

－　印刷又はコーティングされたばかりの下地材が第２の印刷ユニット内で印刷、コーティング又はその他の処理を受ける前に、この下地材上の水性又はフレキソ印刷用インキ又はコーティング材料を乾燥させる段階

が第１の印刷ユニット内で連続して行われることを特徴とする印刷方法。

【請求項２】　－　第１の印刷ユニット内で下地材に対し水性又はフレキソ印刷用インキ又はコーティング材料の下塗りを施す段階；

－　下塗りの間に、塵埃、裏移り防止スプレー粉末などといった粒子状材料をトラップし密封する段階；

－　第２の印刷ユニット上で下地材が印刷されるか又はコーティングされる前にこの下地材上の下塗りを乾燥する段階；及び

－ 第２の印刷ユニット内で、コーティングされたばかりの下地材にオーバープリンティングする段階
を含む、請求項１に記載の印刷方法。

【請求項３】 印刷又はコーティングされたばかりの下地材が第１の印刷ユニットの圧胴と接触している間に、この下地材上に加熱空気を導くことによって、乾燥段階が実施される、請求項１に記載の印刷方法。

【請求項４】 －印刷又はコーティングされた下地材を第１及び第２の印刷ユニットの間に配置された中間渡し胴に移送させる段階；及び
－ 印刷又はコーティングされたばかりの下地材が中間渡し胴と接触している間にこの下地材を乾燥させる段階
を含む、請求項１に記載の印刷方法。

【請求項５】 乾燥段階は、印刷又はコーティングされたばかりの下地材が第２の印刷ユニット内の圧胴と接触している間にこの下地材上に加熱空気を導くことによって行われる、請求項１に記載の印刷方法。

【請求項６】 乾燥段階は、印刷又はコーティングされたばかりの下地材上に乾燥装置からの加熱空気を導くことによって行われ、
－ 印刷又はコーティングされたばかりの下地材が第１の印刷ユニットの圧胴と接触している間にこの下地材を乾燥装置の間の露呈ゾーンから高温空気、水分及び揮発分を抽出する段階
を含む、請求項１に記載の印刷方法。

【請求項７】 －印刷又はコーティングされたばかりの下地材を第１及び第２の印刷ユニットの間に配置された中間渡し胴へ移送する段階；
－ 印刷又はコーティングされたばかりの下地材が中間渡し胴と接触している間にこの下地材上に乾燥装置からの加熱空気を導く段階；及び
－ 印刷又はコーティングされたばかりの下地材が中間渡し胴と接触している間にこの下地材と前記乾燥装置の間の露呈ゾーンから高温空気、水分及び揮発分を抽出する段階
を含む、請求項１に記載の印刷方法。

【請求項８】 －第２の印刷ユニット上の圧胴に対し、印刷又はコーティン

グされたばかりの下地材を移送する段階；

－　印刷又はコーティングされたばかりの下地材が第２の印刷ユニットの圧胴と接触している間にこの下地材上に乾燥装置から加熱空気を導く段階；

－　印刷又はコーティングされたばかりの下地材が第２の印刷ユニットの圧胴と接触している間に、この下地材と前記乾燥装置の間の露呈ゾーンから高温空気、水分及び揮発分を抽出する段階

を含む、請求項１に記載の印刷方法。

【請求項９】　版胴、この版胴の上にとりつけられたフレキソ印刷版、ブランケット胴、このブランケット胴の上にとりつけられた版又はブランケット、圧胴及びフレキソ印刷版及び／又はブランケット胴上の版又はブランケットに対して水性又はフレキソ印刷用インキ又はコーティング材料を塗布するためのアプリケータ手段を有する印刷ユニットを含むタイプの輪転オフセット印刷機内で平坦でない印刷又はコーティング層を下地材上に提供するための方法であって、

－　フレキソ印刷版に対して比較的粗い粒子を含む水性又はフレキソ印刷用インキ又はコーティング材料の第１の下位層を塗布する段階；

－　フレキソ印刷版からブランケット胴上の版又はブランケットまで比較的粗い粒子の印刷インキ又はコーティング材料を移送させる段階；

－　比較的粗い粒子の印刷インキ又はコーティング材料の上に比較的細かい粒子を含む水性又はフレキソ印刷用インキ又はコーティング材料の第２の下位層を塗布する段階；

－　下地材がブランケット胴と圧胴の間のニップを通して移送されるにつれてこの下地材上にブランケット胴上のブランケット又は版から粗粒子及び微粒子のインキ又はコーティング材料を移送する段階；及び

－　印刷又はコーティングされたばかりの下地材がひきつづき印刷、コーティング又はその他の処理を受ける前に、この下地材を乾燥する段階

が印刷ユニット内で連続的に行われることを特徴とする方法。

【請求項１０】　粗粒子及び微粒子が、銅、亜鉛及びアルミニウムを含む群から選択された金属を含んでなる、請求項９に記載の方法。

【請求項１１】　粗粒子及び微粒子が、雲母、シリコン、ストーングリット

及びプラスチックからなる群から選択された非金属材料を含んでなる、請求項９に記載の方法。

【請求項１２】　粗粒子及び微粒子がそれぞれさまざまな粒子状材料を含んでいる、請求項９に記載の方法。

【請求項１３】　版胴、この版胴上にとりつけられた印刷版、ブランケット胴、このブランケット胴上にとりつけられた版又はブランケット、圧胴、フレキソ印刷版及び／又はブランケット胴上の版又はブランケットに対して同時に又は別々に印刷インキ又はコーティング材料を塗布するためのインキング／コーティング装置を含み、しかも印刷されたばかりの下地材上にインキフィルム又はコーティング材料層を印刷するために最後の印刷ユニットに隣接してとりつけられたインキング／コーティング胴を含むタイプの輪転オフセット印刷機の最後の印刷ユニット上で下地材を印刷又はコーティングするための方法において、

－　印刷版に対して第１の下位印刷インキフィルム又はコーティング材料層を塗布する段階；

－　印刷版からブランケット胴上の版又はブランケットまで印刷インキ又はコーティング材料を移送する段階；

－　ブランケット胴上の版又はブランケットの上の第１の下位フィルム又は層の上に第２の下位印刷インキフィルム又はコーティング材料層を塗布する段階；

－　ブランケット胴と圧胴の間のニップを通って下地材が移送されるにつれて、ブランケット胴上のブランケット又は版から下地材上にインキ又はコーティング材料を移送する段階；及び

－　第２の下位フィルム又は層が最後の圧胴上で印刷又はコーティングされている間に、第２の下位インキフィルム又はコーティング材料層の上に第３の下位印刷インキフィルムはコーティング材料層を同時に印刷する段階

を含むことを特徴とする方法。

【請求項１４】　版胴、この版胴上にとりつけられたフレキソ印刷版、ブランケット胴、このブランケット胴上にとりつけられた版又はブランケット、圧胴及びフレキソ印刷版及び／又はブランケット胴上の版又はブランケットに対してフレキソ印刷用又は水性印刷インキ又はコーティング材料を塗布するためのイン

キング／コーティング装置を有する印刷ユニットを含むタイプの輪転オフセット印刷機内で下地材を印刷又はコーティングするための方法において、

－　フレキソ印刷又は水性印刷インキ又はコーティング材料の第１の下位フィルム又は層をフレキソ印刷版に対し塗布する段階；

－　フレキソ印刷版からブランケット胴上の版又はブランケットまで、印刷インキ又はコーティング材料を移送する段階；

－　ブランケット胴上の版又はブランケット上の第１の下位フィルム又は層の上に水性又はフレキソ印刷用インキ又はコーティング材料の第２の下位フィルム又は層を塗布する段階；

－　ブランケット胴と圧胴の間のニップを通して下地材が移送されるにつれて、下地材上にブランケット胴上のブランケット又は版からインキ又はコーティング材料を移送する段階；及び

－　印刷又はコーティングされたばかりの下地材がひきつづき印刷、コーティング又はその他の処理を受ける前に、この下地材を乾燥させる段階

を含むことを特徴とする方法。

【請求項１５】　印刷ユニットが輪転オフセット印刷機の最後の印刷ユニットであり、下地材走行路に沿って印刷されたばかりの下地材を移送するため最後の印刷ユニット上に紙取り胴がとりつけられており、

－　紙取り胴上に版又はブランケットをとりつけることによって紙取り胴を修正する段階；

－　修正された紙取り胴の版又はブランケットまでインキ又はコーティング材料を移送する段階；及び

－　印刷又はコーティングされたばかりの下地材が最後の印刷ユニットの最後の圧胴上にある間に、同時に、第２の下位フィルム又は層の上に版又はブランケットから水性又はフレキソ印刷インキ又はコーティング材料の第３の下位フィルム又は層を移送する段階

を含む、請求項１４に記載の輪転オフセット印刷機内で下地材を印刷又はコーティングする方法。

【請求項１６】　供給物コンテナから前記インキング／コーティングアプリ

ケータ手段まで、及び前記インキング／コーティングアプリケータ手段から供給物コンテナまで液体インキ又はコーティング材料を循環させる段階；及び

－　液体インキ又はコーティング材料が循環させられるにつれて、これを加熱又は冷却する段階

を含む、請求項１、９、１３又は１４のいずれか１項に記載の輪転オフセット印刷のための方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】

本発明は一般に、枚葉紙供給型又は巻取紙供給型輪転オフセット石版印刷機、より詳細に言うと、あらゆる石版印刷機の第１の又はそれに続くいずれかの印刷ユニットの版及びブランケットに対し同時に塗布される水性又はフレキソ印刷用インキ、下塗剤又は保護／装飾コーティングのインライン塗布のための新しくかつ改良型のインキング／コーティング装置に関する。

【０００２】

【従来の技術】

従来の枚葉紙供給型輪転オフセット印刷機は、標準的に、個々の枚葉紙が中に供給され印刷される単数又は複数の印刷ユニットを含んでいる。最後の印刷ユニットの後、印刷されたばかりの枚葉紙は、デリバリコンベヤによって印刷機のデリバリ端部まで移送され、ここで、印刷及び／又はコーティングされたばかりの枚葉紙は収集され、均等に積み重ねられる。標準的な枚葉紙供給型輪転オフセット石版印刷機、例えばハイデルベルグスピードマスター印刷機ラインにおいて、デリバリコンベヤは、最後の圧胴から印刷されたばかりの枚葉紙をつかみ、そして引っぱり、枚葉紙を枚葉紙デリバリスタッカまで搬送するグリッパ棒を支持する一対のエンドレスチェーンを含んでいる。

【０００３】

枚葉紙供給型輪転オフセット印刷機と共に用いられるインキは通常、湿潤であり、かつ粘着性があるため、１つの印刷ユニットからもう１つの印刷ユニットまで枚葉紙が移送されるにつれて、この印刷又はコーティングされたばかりの枚葉

紙がマーキング及び汚損を受けることのないように特別な予防措置を講じなければならない。枚葉紙の表面上の印刷されたインキは比較的緩慢に乾燥し、印刷ユニット間でのその後の移送中に容易に汚される。マーキング、汚損及びしみは、すべて共同発明者であるHoward W. DeMoore に対するものである米国特許第５，１１３，２５５号；５，１２７，３２９号；５，２０５，２１７号；５，２２８，３９１号；５，２４３，９０９号；及び５，４１９，２５４号に記述され、米国テキサス州ダラスのPrinting Research Inc.がその商標ＢＡＣＶＡＣTMの名で製造販売している真空式枚葉紙移送装置によって防ぐことができる。

【０００４】

一部の印刷業務では、印刷されたばかりの枚葉紙のすべて又は一部分上に保護及び／又は装飾用コーティング材料を塗布することによって、裏移りが防がれている。一部のコーティングは、インキが裏移りしないように印刷したばかりの枚葉紙の外観を改善するために、印刷したばかりの枚葉紙上に液体溶液として塗布されるＵＶ硬化型又は水性分散樹脂で形成されている。このようなコーティングは、ポスター、レコードジャケット、冊子、雑誌、折畳み箱などを印刷する上で装飾又は保護用仕上げが行われる場合に、特に望ましい。

【０００５】

コーティング塗布ユニットとして印刷機の最後の印刷ユニットを使用することによってインライン印刷作業としてコーティングを施すため、さまざまな手段が講じられてきた。例えば、米国特許第４，２７０，４８３号；４，６８５，４１４号；及び４，７７９，５５７号は、印刷したばかりの枚葉紙の上にコーティング材料を塗布するのに印刷機の最後の印刷ユニットのブランケット胴を使用できるようにするために、所定の位置に移動させることのできるコーティング装置を開示している。米国特許第４，８４１，９０３号（Bird）では、最後の印刷ユニットがコーティング目的でのみ使用できるように、印刷機の最後の印刷ユニットの版胴又はブランケット胴の間を選択的に移動することのできるコーティング装置が開示されている。しかしながら、このタイプのコーティング装置が使用されているとき、最後の印刷ユニットは、枚葉紙にインキを印刷するのに使用できず、コーティング作業のためにしか使用できない。したがって、このタイプのイン

ラインコーティング装置でコーティングする間、最後の印刷ユニットはコーティングユニットに転換されているため、印刷機はこの印刷ユニットでの印刷能力を失う。

【0006】

米国特許第5，107，790号（Sliker et al）のコータは、コータヘッドをブランケットシリンダ上のブランケットと係合するよう伸長させたり、引込めたりするために傾斜したレールに沿って引込めることが可能になっている。そのサイズのため、レール引込めることが可能なコータは、印刷機の最後の印刷ユニットとデリバリシードスタッカの間にのみ設置することができ、ユニット間コーティングのために使用することはできない。米国特許第4，615，293号（Jahn）のコータは、版及びゴムブランケットに対しラッカーを塗布するため、転換された印刷ユニットの湿し装置側に位置づけされた2基の別々の独立コータを提供している。その結果、版及びブランケットは具備されているものの、Jahnのコーティングユニットは専用コーティング作業のみに制限されている。

【0007】

例えば、印刷したばかりの枚葉紙がなおも印刷機の最後の圧胴上にある間にこの枚葉紙に対してコーティング材料を塗布するように位置づけされたアプリケータローラをもつコーティング装置を開示するHoward W. DeMoore(共同発明者でかつ譲受人）に対する米国特許第5，176，077号に規定されているように、インラインコーティングが使用されている場合の印刷ユニットの損失を克服するための提案がなされてきた。こうして、最後の印刷ユニットは、同時に印刷とコーティングを行うことができ、印刷ユニットの能力の損失が結果としてもたらされることは全くない。

【0008】

いくつかの従来のコーターはレール取付け型であり、印刷機のスペースを大きく占有し、印刷機へのアクセスを減少させている。このようなコーターを作動的コーティング位置から非作動的位置まで引込め、かくして印刷ユニットへのアクセスを減らすための精巧な装置が必要とされる。

【0009】

したがって、印刷ユニットの損失を結果としてもたらさず、印刷機の長さを延ばさず、しかも第1の印刷ユニットを含むあらゆる石版印刷機のあらゆる石版印刷ユニット上で、版及びブランケット上に同時に水性及びフレキソ印刷用インキ及びコーティング材料を印刷・コーティングすることのできるインラインインキング/コーティング装置に対する必要性が存在する。

【0010】

【発明が解決しようとする課題】

したがって、本発明の一般的目的は、版胴上の版に対してか又はブランケット胴上の版又はブランケットに対してインキ又はコーティング材料を選択的に塗布することのできる改良型インキング/コーティング装置を提供することにある。

【0011】

本発明の1つの特定の目的は、版胴上の版又はブランケット胴上の版又はブランケットのいずれかとインキング/コーティング係合状態になるよう伸張できる、上述の特徴をもつ改良型インキング/コーティング装置を提供することにある。

【0012】

本発明の関連する目的は、印刷機のあらゆる石版印刷ユニット上にとりつけることができ、しかも版胴、ブランケット胴又は隣接する印刷ユニットへのオペレータのアクセスと干渉しない上述の特徴をもつ改良型インキング/コーティング装置を提供することにある。

【0013】

本発明のもう1つの目的は、版胴に隣接する作動的インキング/コーティング係合位置から非作動的引込み位置まで移動させることのできる上述の特徴をもつ改良型インキング/コーティング装置を提供することにある。

【0014】

本発明のさらにもう1つの目的は、あらゆる輪転オフセット印刷機上の石版印刷、フレキソ印刷及び乾式印刷プロセスと組合わせて水性、フレキソ印刷用及びUV硬化型のインキ及び/又はコーティングを塗布するために使用することのできる、前述の特徴をもつ改良型インキング/コーティング装置を提供することに

ある。

【0015】

本発明の関連する目的は、例えば第1の印刷ユニットといった1つの印刷ユニット上に水性又はフレキソ印刷用インキ又はコーティング材料を塗布し、乾式、水性、フレキソ印刷用又は石版印刷用のインキ又はコーティング材料を次の印刷ユニット上で直ちにオーバープリント又はオーバーコーティングさせることができるように次の印刷ユニット上で印刷又はコーティングする前にインキ又はコーティング材料を乾燥させることのできる、前述の特徴をもつ改良型インキング／コーティング装置を提供することにある。

【0016】

本発明のさらにもう1つの目的は、単一の作動位置から、そして単一のインキング／コーティング装置から印刷機の印刷ユニットの版及び／又はブランケットに対して別々に及び／又は同時にインキ又はコーティング材料を塗布することのできる多色輪転オフセット印刷機上で使用するための改良型インキング／コーティング装置を提供することにある。

【0017】

本発明の関連する目的は、インキング／コーティング装置を版からブランケットの印刷又はコーティングへと、又はその反対へと転換させる場合に印刷ユニットを調整又は変更する必要が事実上全くない、前述の特徴をもつ改良型インキング／コーティング装置を提供することにある。

【0018】

本発明のもう1つの目的は、版胴上の版又はブランケット胴上の版又はブランケットのいずれかとインキング／コーティング係合状態となるようにあらゆる石版印刷ユニットの湿し装置のスペース内に作動的にとりつけることができ、しかも印刷ユニット間のユニット間スペース内のオペレータの移動又は活動と干渉しない改良型インキング／コーティング装置を提供することにある。

【0019】

【課題を解決するための手段】

上述の目的は、作動的（刷り中）インキング／コーティング位置と引込んだ係

合解除（非刷り中）位置の間で移動するため輪転オフセット印刷機のあらゆる印刷ユニットの湿し装置側にとりつけられる引込み式インラインインキング／コーティング装置によって達成される。インキング／コーティング装置は、版胴上の版又はブランケット胴上のブランケットと係合したり係合解除するように移動することのできるアプリケータローラを含んでいる。インキング／コーティングアプリケータヘッドは、版胴及びブランケット胴と平行に整列させた状態で印刷ユニットの従来の湿し装置スペース内で印刷機のサイドフレーム上にとりつけられるピボットピンにより印刷ユニットに対し旋回する形で結合されている。この湿し装置スペースでの取付け配置により、インキング／コーティングユニットを、印刷機上のあらゆる隣接印刷ユニットの間に設置することが可能になっている。

【００２０】

好ましい実施態様においては、アプリケータヘッドには垂直に間隔をとって設けられたクレードル部材対が含まれており、アプリケータヘッドが作動的位置にあるとそれぞれに、一方のクレードル対は版胴と心合せした状態でインキング／コーティングアプリケータローラを支持するように適合されており、もう一方のクレードル対はブランケット胴と心合せした状態でインキング／コーティングアプリケータローラを支持する。ピボットピンによって提供される旋回式支持のため、アプリケータヘッドは、印刷ユニット胴へのオペレータのアクセスを制限することなく、そして印刷ユニットがその印刷能力を損失することなく、従来の湿し装置スペース内で利用できる制限された空間の中に引込められたり伸長されたりすることができる。

【００２１】

インキング／コーティング装置をフレキソ印刷版及び水性又はフレキソ印刷用インキ又はコーティング材料と組合わせて使用する場合、印刷又はコーティングされたばかりの枚葉紙上の水性又はフレキソ印刷用インキ又はコーティング材料の水成分は、枚葉紙が次の印刷ユニット上で印刷又はコーティングを受ける前に乾燥しているように、高速高温空気式ユニット間乾燥装置及び高体積型熱・水分抽出装置アセンブリにより、蒸発及び乾燥させられる。この急速乾燥プロセスにより、例えば不透明ホワイト又はメタリック（ゴールド、シルバー又はその他の

メタリック）インキといったインキフィルム又はベース層を第１の印刷ユニット上で印刷し、次に、逆トラッピングやドットゲインなしで、次の印刷ユニット上でオーバープリントすることが可能となる。

【００２２】

本発明の構成及び作動については、本発明の原理及び利点を一例として開示する添付図面と合わせて以下の詳細な説明を考慮することによって理解できることだろう。

【００２３】

【実施例】

本明細書で使用する「処理された」という用語は、石版印刷、乾式印刷、ＵＶ硬化型、水性及びフレキソ印刷用インキ及び／又はコーティングを含む、下地材のいずれかの側に適用できる印刷及びコーティングの方法のことを言う。「下地材」という用語は、枚葉紙及び巻取紙材料を表わす。同様にここで使用されるとおり、「乾式印刷版」というのは、それぞれ親油性及び疎油性であるイメージ部域と非イメージ部域をもつ印刷版のことである。「乾式印刷用インキ」というのは、有意な水性成分を含んでいないオイルベースのインキのことである。「フレキソ印刷版」というのは、フレキソ印刷用インキ又はコーティング材料によって湿潤化できるレリーフ表面をもつ可とう性ある印刷版のことである。「フレキソ印刷用インキ又はコーティング材料」というのは、水、溶剤又はＵＶ硬化型液体の基本成分をもつインキ又はコーティング材料のことである。「ＵＶ硬化型石版印刷用インキ及びコーティング材料」というのは、紫外線の照射を受けることによって写真製版的に硬化（乾燥）され得るオイルベースの印刷用インキ及びコーティング材料のことである。「水性印刷用インキ又はコーティング材料」というのは、溶剤、希釈剤又はビヒクルとして主として水を含有するインキ又はコーティング材料のことである。「レリーフ版」というのは、くぼんだ非イメージ部域に対してもち上ったイメージ部域をもつ印刷版のことである。

【００２４】

例としての図面中に示されているように、本発明は、ここで全体として１２という番号で示された枚葉紙供給型又は巻取紙供給型の輪転オフセット印刷機内で

印刷される枚葉紙又は巻取紙に対して水性、フレキソ印刷用又はＵＶ硬化型のインキ又は保護及び／又は装飾的コーティングを塗布するための、ここで全体として１０という番号で示された新しい改良型インラインインキング／コーティング装置の形で実施される。この例では、図１に示されているように、インキング／コーティング装置１０は、例えばドイツのHeidelberger Druckmaschinen AGがそのHeidelberg Speedmaster SM 102(40", 102cm) という呼称で製造しているもののような、４ユニット型輪転オフセット印刷機１２の中に設置されている。

【００２５】

印刷機１２は、一方の端部、ここでは右端部で、Ｓと呼称されている枚葉紙を個々に順次印刷機の中に供給する枚葉紙フィーダ１６に結合され、そして反対側の端部では、印刷されたばかりの枚葉紙を収集し積み上げる枚葉紙デリバリスタッカ２０と結合されている、印刷機フレーム１４を含んでいる。枚葉紙フィーダ１６と枚葉紙デリバリスタッカ２０の間には、枚葉紙が印刷機１２の中を移送されるにつれてこれに４つの異なる色を印刷することのできる４つの実質的に同一の枚葉紙印刷ユニット２２、２４、２６及び２８が置かれている。印刷ユニットは、サイドフレーム部材１４、１５によって形成された印刷タワーＴ１、Ｔ２、Ｔ３及びＴ４内に収納される。各々の印刷タワーはデリバリー側２５と湿し装置側２７を有している。湿し装置スペース２９は、部分的に、印刷ユニットの湿し装置側でサイドフレームにより囲まれている。

【００２６】

例示されているとおり、印刷ユニット２２、２４、２６及び２８は実質的に同一で、従来とおりの設計のものである。第１の印刷ユニット２２には、インフィード渡し胴３０、版胴３２、ブランケット胴３４及び圧胴３６が含まれ、これらはすべて、印刷ユニットタワーＴ１、Ｔ２、Ｔ３及びＴ４を構成する印刷機サイドフレーム１４、１５の間で平行に整列した状態で回転するように支持されている。最初の３つの印刷ユニット２２、２４及び２６の各々は、印刷されたばかりの枚葉紙を隣接する圧胴から移送し、かつこれらの枚葉紙を中間トランスファドラム４０を介して次に印刷ユニットまで移送するべく配置された渡し胴３８を有する。

【００２７】

最後の印刷ユニット２８は、デリバリシャフト４３上にとりつけられた紙取り胴４２を含む。この紙取り胴４２は、印刷されたばかりの枚葉紙１８が最後の圧胴３６から全体として４４で示されているデリバリコンベヤシステムまで移送されるにつれて、それを支持し、ここでこのデリバリコンベヤシステムは印刷されたばかりの枚葉紙を枚葉紙デリバリスタッカ２０まで移送する。移送中の汚損を防ぐため、本明細書に参考として内含されているHoward, W. DeMooreに対する米国特許第４，４０２，２６７号に記述され、請求されているように、紙取り胴４２上に可とう性のカバリングがとりつけられる。この可とう性カバリングは、米国テキサス州ダラスのPrinting Research Inc.によりその商標ＳＵＰＥＲ　ＢＬＵＥＲ で製造販売されている。場合によっては、このPrinting Research Inc.がその商標ＢＡＣＶＡＣＡ で製造販売している真空式枚葉紙移送アセンブリを、紙取り胴４２と可とう性カバリングと置き換えることもできる。

【００２８】

図２に示されているようなデリバリコンベヤシステム４４は、従来の設計のものであり、一対のエンドレスデリバリグリッパチェーン４６を含んでおり、そのうちの一方のみが、最後の印刷ユニット２８の圧胴３６と紙取り胴４２の間のニップを離れた後の印刷又はコーティングされたばかりの枚葉紙１８の前縁をつかむのに用いられるグリッパフィンガーをもつ側方に配置されたグリッパ棒をチェーンに沿った定間隔をとった場所に支持している形で、示されている。前縁がグリッパフィンガーによってつかまれると、デリバリチェーン４６は枚葉紙を最後の圧胴３６から離れるように引張り、印刷又はコーティングされたばかりの枚葉紙を枚葉紙デリバリスタッカー２０まで搬送する。

【００２９】

デリバリ枚葉紙スタッカーに到達する前に、印刷及び／又はコーティングされたシートＳは、インキ及び／又は保護／装飾用コーティングを乾燥するための赤外線熱放射、高速高温空気流及び高性能熱・水分抽出装置の組合せを含むデリバリ乾燥装置４８の下を通過する。好ましくは、高性能熱・水分抽出装置を含むデリバリ乾燥装置４８は、それをその商標ＡＩＲ　ＢＬＡＮＫＥＴTMの名称で製造

販売する米国テキサス州ダラスのPrinting Research Inc.に対しライセンス付与された本発明の譲受人Howard W. DeMoore に共同譲渡された、Howard C. Secor, Ronald M. Rendleman及びPaul D. Copenhaverによる「赤外線強制空気乾燥装置及び抽出装置」という題の１９９３年９月３日に出願された米国特許出願番号０８／１１６，７１１号の中で記述されているとおりに作られている。

【００３０】

図３に示されている実施例では、第１の印刷ユニット２２には版胴上にとりつけられたフレキソ印刷用印刷版ＰＦがあり、したがって、インキングローラ列も湿しシステムも必要とされない。フレキソ印刷版ＰＦは第２の印刷ユニット２４の版胴上にもとりつけられる。第２の印刷ユニット２４上にとりつけられた状態で示されているインキングローラ列５２のフォームローラは、版の接触を防ぐように引込められロックされる。フレキソ印刷用インキは、インキング／コーティング装置１０により第２の印刷ユニット２４のフレキソ印刷版ＰＦに供給される。

【００３１】

米国デラウェア州ウィルミントンのE.I. du Pont de Nemours 社によって、商標ＣＹＲＥＬR の下で適切なフレキソ印刷版ＰＦが提供されている。もう１つの供給元としては、その商標ＮＹＬＯＦＬＥＸR の下で適切なフレキソ印刷版を提供するドイツ、Ludwingshafen のＢＡＳＦ Aktiengesellschaft がある。

【００３２】

図３及び図４に例示されているような第３の印刷ユニット２６は、石版印刷のために装備されており、インキつぼ５４から版胴３２上にとりつけられた石版印刷用版Ｐまでインキ Ｑを移送するように配置されたインキングローラ列５２を有するインキング装置５０を内含している。これは、インキ出しローラ５６及び呼出しローラ５７によって達成される。インキ出しローラ５６は、インキつぼの中へ突出し、その時点でその表面がインキを拾い上げる。石版印刷用インキＱは、インキ出しローラ５６からインキングローラ列５２まで呼出しローラ５７により移送される。インキングローラ列５２はインキＱを石版印刷版Ｐのイメージ部域に供給する。

【0033】

石版印刷用インキQは石版印刷版Pから、ブランケット胴34上にとりつけられているインキ受容ブランケットBまで移送される。ブランケットB上に支持されているインキングされたイメージは、下地材がブランケット胴34と圧胴36の間のニップを通して移送されるにつれて、この下地材Sへと移送される。

【0034】

図3及び図4に例示されているインキングローラ配置52は、石版インキ印刷版Pと組合わせた使用についての例である。湿し液タンクDFをもつ湿しシステム58が、インキングローラ列52（図4）に結合されているものの、乾式又はフレキソ印刷には不要であることがわかる。

【0035】

印刷ユニット28の版胴32には、乾式印刷版PWが具備されている。乾式印刷版（Waterless printing plates)は乾式平板印刷版（dry plano-graphic printing plates)とも呼ばれ、米国特許第3，910，187号；Re. 30670；4，086，093；及び4，853，313号の中で開示されている。適切な乾式印刷版は、日本国東京のToray Industries Inc. から入手できる。乾式印刷のためには湿しシステムは使用されず、乾式（オイルベースの）印刷用インキが用いられる。乾式印刷PWは、それぞれ親油性／親水性及び疎油性／疎水性であるイメージ部域と非イメージ部域を有する。乾式印刷版PWは彫刻又はエッチングされ、イメージ部域は非イメージ部域に対しくぼんだ状態にある。乾式印刷版PWのイメージ部域は、アプリケータローラ66により移送されるフレキソ印刷用又は水性の印刷インキで盛り換えされる。水性及びオイルベースのインキ及びコーティングは両方とも、非イメージ部域からはね返され、イメージ部域内に保持される。このとき印刷インキ又はコーティングはイメージ部域からインキ又はコーティング受容ブランケットBへと移送され、下地材S上に印刷又はコーティングされる。

【0036】

ある種の印刷業務のためには、例えば図5の印刷ユニット22内で点線により示されているように、ブランケット胴34上のブランケットBといったような弾

力性胴貼り全体にわたり、フレキソ印刷版ＰＦ又は乾式印刷版ＰＷをとりつける。この変形態様の利点は、乾式版ＰＷ又はフレキソ印刷版ＰＦがブランケット胴上でその下にあるブランケットＢ又はその他の弾力性胴貼りによって、弾力性ある状態で支持されるという点にある。弾力性ブランケットＢの半径方向のたわみ及び順応性は、アプリケータローラ６６とフレキソ印刷版又は乾式版の間に、均質な確動係合を提供する。

【００３７】

この配置において、版は版胴３２の上にとりつけられておらず、その代り、乾式版ＰＷがブランケット胴上にとりつけられ、乾式印刷版上のインキングされたイメージは裏移りせず、その代り乾式版ＰＷから下地材Ｓまで直接移送される。印刷されたばかりの枚葉紙上のフレキソ印刷インキの水成分は、印刷されたばかりの水性又はフレキソ印刷インキが次の印刷ユニット上での下地材の印刷の前に乾燥させられるように、高速、高温空気乾燥装置及び高体積熱・水分抽出装置により蒸発させられる。

【００３８】

ここで図２、図３及び図９を参照すると、インキング／コーティング装置１０は、Ｘ軸を中心にした回転のためサイドフレーム１４、１５上に旋回する形でとりつけられている。インキング／コーティング装置１０は、フレーム６０、油圧モータ６２、下部歯車列６４、上部歯車列６５、アプリケータローラ６６、密封型ドクターブレードアセンブリ６８（図６）及びしずく受けＤＰを含み、これらはすべてフレーム６０上にとりつけられている。アプリケータローラ６６の外周表面は、タンク７０の中に入った液体コーティング材料又はインキとの接触により湿潤化される。

【００３９】

油圧モータ６２は、印刷機駆動装置（図示せず）からのＲＰＭ制御信号及び回転速度計７２が発生させたフィードバック信号に応答して、版胴３２及びブランケット胴３４と同期的にアプリケータローラ６６を駆動する。油圧駆動式モータが好ましいが、電気駆動式モータ又はそれと同等のものといったその他の駆動手段を使用することもできる。

【0040】

乾式印刷版システムを用いる場合、乾式印刷用インキ及び乾式印刷用版の温度は、優れたイメージ再生を得るよう精密に制御されなくてはならない。例えば、ＴＯＲＡＹ乾式印刷用版ＰＷでの乾式オフセット印刷のためには、乾式印刷版表面及び乾式インキの温度を例えば２４℃（７５°F)～２７℃（８０°F)といった非常に狭い範囲に制御することが絶対に必要である。

【0041】

ここで図７を参照すると、タンク７０には、熱交換器７１により温度制御されているインキ又はコーティングが供給される。温度制御されたインキ又はコーティング材料は、例えばぜん動ポンプといった容積式ポンプにより、タンク７０及び熱交換器７１を通って供給源７３から供給導管及び戻り導管７７まで、循環させられる。熱交換器７１は、インキ又はコーティング材料を冷却又は加熱し、インキ又はコーティング及び印刷版を望ましい狭い温度範囲内に維持する。

【0042】

本発明の１つの態様に従うと、水性／フレキソ印刷用インキ又はコーティング材料は、乾式印刷版又はフレキソ印刷版であってよい印刷版（図７）まで水性／フレキソ印刷用インキ又はコーティング材料を移送するアプリケータローラ６６へと供給される。乾式印刷版ＰＷに対して水性／フレキソ印刷用インキ又はコーティング材料を塗布するのにインキング／コーティング装置が使用される場合、インキングローラ列５２は必要とされず、印刷版から離れるように引込められる。水性／フレキソ印刷用インキ又はコーティング材料の粘度は温度と共に変動するため、好ましい運転範囲内にインキの粘度を維持するように大気温度の変動を補償するため水性／フレキソ印刷用インキ又はコーティング材料を加熱又は冷却することが必要である。

【0043】

例えば、印刷機の温度は、午前中の６０°F(１５℃）前後から午後の約８５°F(２９℃）以上まで変動し得る。水性／フレキソ印刷用インキ又はコーティング材料の粘度は、印刷機の大気温度が６０°F(１５℃）に近い場合、わずかに高い可能性があり、この粘度は、印刷機の周囲温度が８５°F(２９℃）を上回る場合

、わずかに低い可能性がある。したがって、乾式印刷版の表面温度を規定の温度範囲内に維持するように水性／フレキソ印刷用インキ又はコーティング材料の温度を制御することが望ましい。さらに、フレキソ印刷プロセスと関連してインキ又はコーティング材料が使用されている場合、望ましい範囲内に水性／フレキソ印刷用インキ又はコーティング材料のタックを維持するように、インキ／コーティング材料の温度を制御すべきである。

【０Delete】

アプリケータローラ６６は好ましくは、版又はブランケットに対し測定された量の印刷用インキ又はコーティング材料を移送するアニロックス流体計量ローラである。アニロックスローラの表面には、「セル」と呼ばれる密な間隔をとって設けられた浅いくぼみのアレイが彫刻されている。タンク７０からのインキ又はコーティングは、タンクを通してアニロックスローラが回転するにつれてセルの中へ流れ込む。アニロックスローラの移送表面は、余剰のインキ又はコーティング材料を除去するためにデュアルドクターブレード６８Ａ、６８Ｂで「ドクタリング」（拭うか又はかき落とす）される。アニロックスローラによって計量されるインキ又はコーティングは、セルの中に収納されたものである。デュアルドクターブレード６８Ａ、６８Ｂは同様に、供給物タンク７０も密封している。

【００４５】

アニロックスアプリケータローラ６６は円筒形であり、さまざまなサイズ及び形状のセルを含み、さまざまな直径及び長さで製造することができる。アニロックスローラの体積容量は、セルのサイズ、形状及び単位面積あたりの数によって決定される。意図されている利用分野に応じて、セルパターンは細かくてもよいし（単位面積あたり数多くの小さいセル）、粗くてもよい（単位面積あたり少なめの大きいセル）。

【００４６】

インキング／コーティング装置１０を通してインキ又はコーティング材料を供給することによって、石版印刷ユニットのインキングローラ列に比べ、枚葉紙Ｓに対しより多くのインキ又はコーティング材料を塗布することができる。その上、水性又はフレキソ印刷用インキ又はコーティング材料は石版印刷プロセスによ

り塗布できるものよりもはるかに大きいフィルム厚又は重量で塗布でき、水性又はフレキソ印刷用カラーは湿し溶液によって希釈されないため、色の強度はより強く、よりあざやかである。

【0047】

好ましくは、密封されたドクターブレードアセンブリ68は、本明細書に参考として内含されている、共同発明者であり譲受人であるHoward W. DeMoore に対する米国特許第5，176，077号の中で記述されているとおりに製造される。密封されたタンクを使用する利点は、急速乾燥インキ又はコーティング材料を使用することができるということにある。急速乾燥インキ又はコーティング材料は、開放型インキつぼ53（図8参照）内で使用できる；しかしながら、外気への露呈により急速乾燥インキ又はコーティング材料中の水及び溶剤がさらに速く蒸発することになり、かくしてインキ又はコーティング材料は時期早尚に乾燥し、粘度が変わることになる。その上、開放型インキつぼは、印刷室に望ましくない臭気を発出する。密封されたドクターブレードアセンブリが利用される場合、インキ又はコーティング材料をドクターブレードヘッドまで循環させるポンプ（図7）は好ましくはぜん動ポンプであり、このポンプは、インキ又はコーティングタンク70に供給するフィーダライン内に空気を射出せず、インキ又はコーティング材料内で気泡及び泡が形成しないよう補助する。

【0048】

代替的なアプリケータローラ配置をもつインキング／コーティング装置10が図10～13内に例示されている。この配置において、アニロックスアプリケータローラ66、67の彫刻された計量表面は、第1の彫刻された周辺表面部分66Aを第2の彫刻された周辺表面部分66Bから分離する平滑なシール表面66Cによって仕切られている。同様にして、ドクターブレードタンクのエンドシール134、136（図12）を係合するためアプリケータローラ66の反対側の端部部分上に、平滑なシール表面66D、66Eが形成されている。上部アプリケータローラ67は、平滑なシールバンド67Cによって分離されている彫刻されたアニロックス計量表面67A及び67Bを有する。

【0049】

ここで図１２及び図１３を参照すると、ドクターブレードヘッド６８のタンク７０は、２つの別々のチャンバ７０Ａ、７０Ｂを形成するために湾曲したシール要素により仕切られている。シール要素１３０は、環状溝１３２の中でドクターブレードヘッドに固定される。シール要素１３０は、好ましくはポリウレタンフォーム又はその他の耐久性及び弾力性のある発泡材料で作られる。シール要素１３０は、シールバンド６６によって係合され、かくして、１つのタンクチャンバからその他のタンクチャンバへとインキ又はコーティング材料が漏出するのを阻止するロータリシールを形成している。その上シールバンドは、印刷又はコーティングされた部域を互いから分離する印刷又はコーティングされていない部域を提供し、これは略掛け印刷又は同じ下地材に複数の別々のイメージを印刷するその他の印刷業務にとって必要なことである。

【００５０】

分割アプリケータローラの実施態様がもつもう１つの利点は、それにより複数のフレキソ印刷用インキ又はコーティング材料を同じ石版印刷ユニット内で同時に印刷することができる、という点にある。すなわち、上部ドクターブレードアセンブリのタンクチャンバ７０Ａ、７０Ｂには例えばゴールドインキとシルバーインキを供給し、その一方で下部ドクターブレードアセンブリのタンクチャンバ７０Ａ、７０Ｂには例えば不透明のホワイトインキ及びブルーインキといった２つの付加的なカラーのインキを供給することができる。こうして、いずれかの石版印刷機上の同じ印刷ユニット上で、不透明のホワイトインキにゴールドインキでオーバープリントし、ブルーインキにシルバーインキでオーバープリントすることが可能となる。

【００５１】

その上、上部ドクターブレードタンク内で触媒を使用することができ、下部ドクターブレードタンク内で反応性インキ又はコーティング材料を使用することができる。こうして、例えば改善された化学的耐性及びより高い光沢レベルといったさまざまな効果が得られる。

【００５２】

上部クレードル位置にある分割型アプリケータローラ区分６７Ａ、６７Ｂは、

版の別々の表面部域に対して例えばフレキソ印刷用、水性及びＵＶ硬化型インキ又はコーティング材料といった２つの別々のインキ又はコーティング材料を同時に塗布するために使用できるのに対し、下部アプリケータローラ区分６６Ａ、６６Ｂは、別々のブランケット表面部域に対して同時に重合開始剤層及び微細包埋層を塗布することができる。場合によっては、計量用表面部分６６Ａ、６６Ｂには同時に印刷されつつある異なる印刷効果を提供するための異なるセル計量能力が備わっていてよい。例えば、アニロックスアプリケータローラの１つの半区分の上のスクリーンライン計数は、ハーフトーンイメージについて好ましくは１インチあたり２００～６００ライン（１cmあたり７９～２３６ライン）の範囲内にあり、その他の半区分のスクリーンライン計数は、不透明ホワイトといったような全面網羅の高重量の利用分野について、好ましくは１インチあたり１００～３００ライン（１cmあたり３９～１１８ライン）の範囲内にある。デュアルアプリケータローラと組合わせたこの分割型配置は「略掛け」印刷業務に関連して使用された場合に特に有利である。

【００５３】

再び図８を参照すると、図６に示されているような密封されたドクターブレードタンクアセンブリ６８を使用する代りに、液体インキＱ又はコーティング材料を一定体積収納するインキ出しパン５３によって、開放型インキ出しアセンブリ６９が提供されている。液体インキ又はコーティング材料は、インキ出しパン内のインキＱ又はコーティング材料と接触して回転するパンローラ５５によりアプリケータローラ６６に移送される。分割型アプリケータローラが使用されるならば、パンローラ５５も同様に分割され、パンは図１６に示されているように、分離板５３Ｐにより２つのパン区分５３Ａ、５３Ｂに分割される。

【００５４】

図１６の代替的実施態様においては、パンローラ５５は中央にある環状溝５９により２つのパンローラ区分５５Ａ、５５Ｂに分けられる。分離板５３Ｐは溝５９の中に収容され、この溝と中央で心合せされるが、隣接するローラ面には接触しない。この配置により、複数のインキ又はコーティング材料Ｑ１、Ｑ２が、それぞれ分割されたパンローラ区分５３Ａ、５３Ｂによる移送のため開放パン区分

５５Ａ、５５Ｂ内に収納される。こうして、同じ印刷ユニットのブランケット上又は版上の２つの別々のイメージ部域に対して複数のフレキソ印刷用インク又はコーティング材料を移送することが可能となる。この配置は、略掛け印刷業務又は同じ下地材上に複数の別々のイメージを印刷するその他の印刷仕事のために、特に有利である。

【００５５】

インキング／コーティング装置１０のフレーム６０は、アプリケータローラ６６、歯車列６４、歯車列６５、ドクターブレードアセンブリ６８及び駆動モータ６２を支持するサイド支持部材７４、７６を含む。アプリケータローラ６６は、ソケット７９、８１及びリテーナキャップ１０１、１０３をもつ一対のサイド支持部材７８、８０により形成された下部クレードルアセンブリ１００上で反対側の端部に支持されているスタブシャフト６３Ａ、６３Ｂ上にとりつけられている。このスタブシャフトは、長手方向軸Ａ１（上部クレードル内の軸Ａ２）を中心にしたアプリケータローラ６６の自由な回転を可能にする転がり軸受１０５、１０７の中に収容される。リテーナキャップ１０１、１０３は、スタブシャフト６３Ａ、６３Ｂ及び軸受１０５、１０７をソケット７９、８１内に保持し、旋回軸Ｘと平行に整列させられた状態にアプリケーションローラ６６を保持する。

【００５６】

サイド支持部材７４、７６も同様に、下部側板７８、８０に対して垂直に間隔をとって配置されている１対のサイド支持部材８２、８４によって形成される上部クレードルアセンブリ１０２を有している。各々のクレードル１００、１０２は、版胴３２（図４）上の印刷版Ｐ又はブランケット胴３４上の印刷版Ｐ又はブランケットＢとスポットコーティング又はインキング係合状態になるようにアプリケータローラ６６、６７を保持するためにそれぞれ一対のソケット７９、８１及び８３、８５を有する。

【００５７】

好ましくは、上部クレードル（版）位置にあるアプリケータローラ６７（図８、図９）は、弾力性の移送表面をもつアニロックスローラである。図２に示されているようなデュアルクレードル配置では、印刷機のオペレータはブランケット

インキング／コーティングから版インキング／コーティングへと数分で急速交換することができる。これは、アプリケータローラ６６を解放し、除去し、そして再度位置づけするか又は交換することしか必要でないからである。

【００５８】

同じ石版印刷機の異なる印刷ユニット上でフレキソ印刷モード、水性モード、乾式モード又は石版印刷モードで同時に印刷する能力及び印刷ユニットのうちのいずれか１つの上で版の位置又はブランケットの位置のいずれかから印刷又はコーティングする能力を、ここでは、ＬＩＴＨＯＦＬＥＸTM印刷プロセス又はシステムと呼んでいる。ＬＩＴＨＯＦＬＥＸTMは、本発明の独占実施権者である米国テキサス州ダラスのPrinting Research Inc.の商標である。

【００５９】

ここで図１４を参照すると、代替的設計のインキング／コーティングアセンブリ１０９を有するインキング／コーティング装置１０が、版胴３２上の版Ｐに対してインキ及び／又はコーティング材料を塗布するため、上部クレードル位置に設置されている。この変形実施態様に従うと、弾力性移送表面をもつアプリケータローラ６７Ｒが、測定された量の印刷インキ又はコーティング材料を版Ｐまで移送するアニロックス流体計量ローラに結合されている。アニロックスローラ１１１は、セルが彫刻されている、金属、セラミックス又は複合材料でできた移送表面をもつ。弾力性アプリケータローラ６７Ｒは、アニロックスローラ１１１の計量表面及び版Ｐと移送係合状態で、介在させられている。アプリケータローラ６７Ｒの弾力性移送表面は、版と均等な確動係合を提供する。

【００６０】

ここで図１７を参照すると、ブランケット胴３４上にとりつけられた版又はブランケットに対しフレキソ印刷用又は水性インキ及び／又はコーティング材料Ｑを塗布するため下部クレードルアセンブリ１００内に、代替的なインキング／コーティングアセンブリ１１３をもつインキング／コーティング装置１０が設置される。図６に示されているような密封型デュアルドクターブレードタンクアセンブリ６８を使用する代りに、開放型単一ドクターブレードアニロックスローラアセンブリ１１３に、開放型インキ出しパン１１７内に収納された液体インキＱ又

はコーティング材料が供給される。液体インキ又はコーティング材料Qは、アニロックスローラ６６がインキ出しパン１１７内で回転するにつれてその彫刻された移送表面に対して移送される。余剰のインキ又はコーティング材料Qは、単一のドクターブレード６８Bにより彫刻された移送表面から除去される。液体インキ又はコーティング材料Qは、例えば図１７に示されているドラム７３といった印刷機外の供給源から供給導管１１９を通ってインキ出しパン１１７までポンプ１２０により圧送される。

【００６１】

全体的なインキング又はコーティング業務のために、アニロックスローラ６６の計量用移送表面はその周辺表面全体にわたり広がっている。しかしながら、例えば略掛け印刷業務といった同じ下地材上に複数の別々のイメージを印刷するいくつかの印刷業務については、アニロックスアプリケータローラ６６の計量用移送表面は、図１１及び図１８に示されているように第１及び第２の計量用移送表面６６A、６６Bを分離する中央にある環状アンダーカット溝６６Cによって仕切られている。

【００６２】

単一のドクターブレード６８Bは、分割された計量用移送表面６６A、６６Bに対して同時に拭う１つの縁部６８Eを有する。この単一ブレードでは、例えばドラム７３A、７３B、デュアル供給ライン１１９A、１１９B、及びデュアルポンプ１２０A、１２０Bといったデュアル供給源を提供するのに、分割型アニロックスローラの実施態様１１３が必要である。さらにインキ出しパン１１７も分割され、パン１１７は、図１８に示されているように分離板１２１によって２つのパン区分１１７A、１１７Bに分けられている。この分離板１２１は、アンダカット溝６６Cと中央で心合せされているが、隣接するローラ面には接触しない。

【００６３】

単一ブレードの分割型アニロックスアプリケータローラアセンブリ１１３は、下部クレードル位置にとりつけられた状態で示されているが（図１７）、単一ブレードの分割型アニロックスアプリケータローラアセンブリ１１３を上部クレー

ドル位置でとりつけ、ここで使用することも同様に可能である。

【００６４】

本発明のもう１つの態様に従うと、インキング／コーティング装置１０は、単一ヘッドのデュアルクレードルインキング／コーティング装置１０をあらゆる石版印刷ユニット上にとりつけることができるようにする水平ピボットピン８８Ｐ、９０Ｐ上に旋回する形で結合されている。ここで図９を参照すると、水平ピボットピン８８Ｐ、９０Ｐは印刷ユニットの従来の湿し装置スペース２９内にとりつけられ、それぞれ印刷機サイドフレーム１４、１５に固定されている。好ましくは、ピボット支持ピン８８Ｐ、９０Ｐは、ネジ部品により印刷機サイドフレームに固定される。ピボット支持ピンはインキング／コーティング装置１０のサイド支持部材７４、７６を交叉する円形開口部８８、９０内に収容される。水平支持ピン８８Ｐ、９０Ｐは、回転軸Ｘ及び版胴及びブランケット胴を平行に整列した状態で配置され、互いに長手方向に整列させせられている。

【００６５】

好ましくは、ピボットピン８８Ｐ、９０Ｐは、アプリケータローラ６６、６７の回転軸Ａ１、Ａ２がニップ接触点Ｎ１、Ｎ２との関係において高くなるように、湿し装置スペース２９の中に位置づけされている。この配置により、アプリケータローラ６６とブランケットシリンダ３４上のブランケットの間の移送点（図８に示されている）及びアプリケータローラ６６と版胴３２上の版の間の移送点（図５に示されている）は、それぞれ版胴及びブランケット胴の半径ラインＲ１、Ｒ２より上にある。こうしてインキング／コーティング装置１０は、パワーアクチュエータアーム１０４Ａ、１０６Ａの単一伸長ストロークに応えてブランケット胴との関係における非刷り中位置までアプリケータローラ６６を引込めるべく時計まわりに移動することが可能となる。同様にして、アプリケータローラ６６は、それぞれアクチュエータアーム１０４Ａ、１０６Ａの単一の引込みストロークにより図４、５、６及び８に示されているとおりの刷り中作動的位置まで反時計まわりに移動させせられる。

【００６６】

好ましくは、ピボットピンは鋼で作られ、サイド支持部材はアルミニウムでで

きており、円形開口部８８、９０を縁どるアルミニウムのカラー部分及び鋼製ピボットピンが低摩擦ジャーナルを形成する。この配置により、インキング／コーティング装置１０はピボットピン８８Ｐ、９０Ｐとの関係において時計回り及び反時計回りに自由に回転することができる。標準的には、回転の弧長は約５０ミル（約１．５mm）である。したがって、インキング／コーティング装置１０は、刷り中の位置及び非刷り中位置において印刷ユニットの湿し装置スペース２９内にほぼ完全に閉じ込められている。

【００６７】

クレードルアセンブリ１００及び１０２は、インキング／コーティング装置１０が作動的（刷り中）位置まで伸長された時点でそれぞれ版胴又はブランケット胴とインキング／コーティング心合せ状態に、アプリケータローラ６６を位置づけする。その上、インキング／コーティング装置１０は湿し装置２９内に設置されているため、この装置１０は、印刷機サイドフレーム又は印刷機のその他の部品により妨害されることなく伸長及び引込み中に小さな弧全体を通して自由に回転することができる。このため、あらゆる石版印刷ユニット上にインキング／コーティング装置１０を設置することが可能となる。さらに、湿し装置スペース２９内のその内部取りつけ位置のため、インキング／コーティング装置１０の印刷ユニット間のスペース内への突出は最小限である。こうして、アプリケータヘッドが作動的（刷り中）位置及び引込み（非刷り中）位置にある場合に、オペレータは制約なく印刷ユニットにアクセスすることができる。

【００６８】

図４及び図５に示されているように、インキング／コーティング装置１０の動きは、引込み（非刷り中）位置から作動的（刷り中）位置まで反時計回りである。

【００６９】

湿し装置側の設置が好ましいものであるが、インキング／コーティング装置１０は、印刷ユニットのデリバリ側で作動するように適合させることができ、ここで、このインキング／コーティング装置は、印刷ユニットのデリバリ側２５でブランケット胴上のブランケット又は版胴上の版のいずれかとアプリケータローラ

を係合させるため、引込み（非刷り中）位置から刷り中位置まで移動可能である。

【００７０】

作動的（刷り中）位置までのインキング／コーティング装置１０の動きは、パワーアクチュエータ、好ましくはそれぞれ伸長／引込み可能なパワートランスファアーム１０４Ａ、１０６Ａをもつ複動型空気圧シリンダ１０４、１０６によって生成される。第１の空気圧シリンダ１０４は、ピボットピン１０８により印刷機フレーム１４に旋回する形で結合され、第２の空気圧シリンダ１０６はピボットピン１１０により印刷機フレーム１５に旋回する形で結合されている。空気圧シリンダ１０４、１０６の選択的起動に応えて、パワートランスファアーム１０４Ａ、１０６Ａは伸長するか又は引込められる。パワートランスファアーム１０４Ａは、ピボットピン１１２によりサイド支持部材７４に旋回する形で結合される。同様にして、パワートランスファアーム１０６Ａはピボットピン１１４によりサイド支持部材７６に旋回する形で結合されている。

【００７１】

パワーアームが伸長するにつれて、インキング／コーティング装置１０はピボットピン８８Ｐ、９０Ｐ上で時計回りに回転させられ、かくしてアプリケータローラ６６を、非刷り中位置まで移動させる。パワーアームが引込むにつれて、インキング／コーター装置６０はピボットピン８８Ｐ、９０Ｐの上を反時計回りに回転させられ、かくしてアプリケータローラ６６を刷り中位置まで移動させる。空気圧アクチュエータにより加えられたトルクはピボットピン１１２及びピボットピン１１４を通してインキング／コーティング装置まで伝達される。

【００７２】

調整可能なストッパアセンブリ１１５により、版胴又はブランケット胴との関係におけるアプリケータローラの刷り中位置及びローラ係合圧力の微調整が提供される。調整可能なストッパアセンブリ１１５は、ベルクランク１１８と係合可能なねじ込みボルト１１６を有する。ベルクランク１１８は、ピン１２０上のサイド支持部材７４に対して旋回する形で結合されている。ベルクランク１１８の片端はねじ込みボルト１１６により係合可能であり、カムローラ１２２がその反

対側端部で回転するようにとりつけられている。係合衝撃点は、アプリケータローラ６６が版Ｐ又はブランケットＢとインキング／コーティング係合するよう適切に位置づけられ、インキング／コーティングアセンブリ６０が作動的位置まで移動された時点で望ましい量のインキング／コーティング圧力を提供するように、ボルト１１６の回転によって調整される。

【００７３】

この配置により、インラインインキング／コーティング装置は、隣接するどの印刷ユニットの間のユニット間スペースも侵害することなく、しかもインキング／コーティング装置が伸長（非刷り中）位置又は引込み（刷り中）位置にある場合に印刷ユニットの各胴へのアクセスを阻止したり妨害することなく、有効に作動することができる。その上、インラインインキング／コーティング装置が引込み位置にある場合、ドクターブレードタンク及びコーティング循環ラインは、印刷機が作動している間ならびに１つの業務からもう１つの業務へ又は１つのタイプのインキ又はコーティングからもう１つのタイプのものへと交換するために印刷機が停止させられた時点で、自動的にドレーン及びフラッシングされ得る。

【００７４】

水性フレキソ印刷インキで印刷又はコーティングされる下地材には、乾燥のために高速高温空気が必要である。不透明ホワイト又はメタリックゴールドといったフレキソ印刷用インキを印刷する場合には、オーバープリンティングの前に、印刷ユニット間で印刷済み下地材を乾燥させることがつねに必要である。本発明によると、印刷又はコーティングされたばかりの下地材Ｓの表面上の水成分は、図２、図４及び図５で示されているように、高速の高温空気ユニット間乾燥装置及び高体積熱・水分抽出装置ユニット１２４、１２６及び１２８によって蒸発及び乾燥させられる。乾燥装置／抽出装置ユニット１２４、１２６及び１２８は、１つの印刷ユニットの圧胴３６及び中間トランスファドラム４０によりもう１つの渡し胴３０及び次の印刷ユニットの圧胴３６まで、印刷／コーティングされたばかりの下地材が移送されるにつれて、この下地材上に高速加熱空気を導くように方向づけされている。この配置により、印刷されたばかりのフレキソ印刷インキ又はコーティング材料は、下地材Ｓが次の印刷ユニットによってオーバープリ

ントされる前に乾燥させられる。

【0075】

高速の高温空気乾燥装置及び高性能熱・水分抽出装置ユニット１２４、１２６及び１２８は、印刷又はコーティングされたばかりの各々の枚葉紙又は巻取紙の表面に付着する湿った空気層をこすり、分散させる高速エアジェットを利用する。各乾燥装置の中で、高速空気は、空気送り出しバッフル管内の抵抗加熱要素を横断して流れるにつれて加熱される。高温空気の高速ジェットは、多数の空気流アパーチャを通して露呈ゾーンＺ（図４及び図５）内に放出され、それぞれ圧胴３６及びトランスファドラム４０により移送されている印刷／コーティングされたばかりの枚葉紙Ｓ上に放出される。

【0076】

各々の乾燥装置アセンブリには、間隔をとって並んだ形で配置されている一対の空気送り出し乾燥装置ヘッド１２４Ｄ、１２６Ｄ及び１２８Ｄが含まれている。高速、高温空気乾燥装置及び高性能熱・水分抽出装置ユニット１２４、１２６及び１２８は、好ましくは、本明細書に参考として内含され米国テキサス州ダラスのPrinting Research Inc.によりその商標ＳＵＰＥＲ　ＢＬＵＥ　ＨＶTMで市販されている、本発明の共同発明者であり譲受人であるHoward W. DeMoore に対する「高速高温空気乾燥装置」という題の、１９９３年１０月６日に提出された同時係属米国特許出願第０８／１３２，５８４号の中で開示されているとおりに製造される。

【0077】

印刷又はコーティングされた各枚葉紙の表面から移動させられた水分を含む高温空気は、高体積抽出装置１２４、１２６及び１２８により、乾燥装置露呈ゾーンＺから抽出され、印刷ユニットから排出される。各々の抽出装置ヘッドは、乾燥装置ヘッド１２４Ｄ、１２６Ｄ及び１２８Ｄに結合された抽出装置マニホルド１２４Ｅ、１２６Ｅ及び１２８Ｅを含み、乾燥装置ヘッドの間の長手方向空隙Ｇを通して水分、揮発分、臭気及び高温空気をひき抜く。抽出が乾燥と同時に行われる場合に、最高の結果が得られる。好ましくは、図４に示されているように、各乾燥装置の場所で、露呈ゾーンＺに対し抽出装置が密に結合されている。抽出

装置ヘッド１２４Ｅ、１２６Ｅ及び１２８Ｅは、長手方向抽出装置空隙Ｇが露呈ゾーンＺ内に直接面している状態で、それぞれ乾燥装置ヘッド１２４Ｄ、１２６Ｄ、１２８Ｅ上にとりつけられている。この配置に従うと、各々の印刷又はコーティング済み枚葉紙は、次の印刷ユニット上で印刷される前に乾燥される。

【００７８】

ユニット間高速高温空気乾燥装置／抽出装置１２４、１２６及び１２８によって提供される比較的穏やかな温度で、フレキソ印刷で使用される水性の水ベースインキは蒸発する。フレキソ印刷用インキ又はコーティング材料は、次の印刷ユニット上でオーバープリントされる前に乾燥されるため、鮮明度及び印刷の質は実質的に改善される。印刷されたばかりのフレキソ印刷用インキは乾燥しているため、ドットゲインは実質的に低減し、次の印刷ユニットのブランケット上の逆トラッピングは事実上削除される。このユニット間乾燥／抽出配置により、第１の印刷ユニット上でメタリックインキ及び不透明のホワイトインキといったフレキソ印刷用インキを印刷し、次に第２以降の印刷ユニット上でドライトラッピング及びオーバープリンティングすることが可能となる。

【００７９】

その上、この配置により、リント、塵埃、噴霧粉末及びその他の砕片をトラッピングして密封し、次の印刷ユニットでオーバープリントできる、より平滑でより耐性のある印刷表面を提供するべく、再生紙、厚紙、プラスチックなどのような最もグレードの低い下地材に対してフレキソ印刷用、水性又はＵＶ硬化型のコーティング材料が塗布されるコーターとして、第１の印刷ユニット２２を使用することが可能となる。

【００８０】

最初の下位（下塗り）水性コーティング層が、例えば再生紙やプラスチックといったような低級の粗い下地材の表面を密封し、オーバープリントされたドットの精細度を改善し、ストライクスルー（裏板４）及びショースルー（透き通し）を防ぎながらより良好なインキの付きを提供する。このとき、下塗り全体にわたり下流にフレキソ印刷用ＵＶ硬化型コーティング材料を塗布し、かくしてより高いコーティングの光沢を生み出すことができる。

【００８１】

好ましくは、アプリケータローラ６６は、ブランケット胴３４上のブランケットＢ又はその他の弾力性材料にインキ又はコーティング材料を塗布するのに使用される場合、複合炭素繊維材料、金属又はセラミックスコーティングされた金属で作られている。アプリケータローラ６６が胴に適用される場合、これは好ましくは、弾力性の圧縮性移送表面をもつアニロックスローラとして構成される。適切な弾力性ローラ表面材料としては、BunaＮ合成ゴム及びＥＰＤＭ（ターポリマーエラストマー）が含まれる。

【００８２】

プロトタイプテストにおいて、インキング／コーティング装置１０が、蛍光物(Day Glo)、パール、メタリック（ゴールド、シルバー及びその他のメタル）、光る物、ひっかくと芳香が出るもの（スクラッチアンドスニフ）（微細包埋フラグランス）、ひっかくと何かが現われ出る物（スクラッチアンドリビール）、発光物、感圧接着剤など、ならびにＵＶ硬化型及び水性コーティングといったものを含む広範囲にわたるインキ及びコーティングタイプを塗布できるということが実証されてきた。

【００８３】

湿し装置アセンブリを印刷ユニットからとり外した状態で、フレキソ印刷用インキ及び／又はコーティングをフレキソ印刷用又は乾式印刷用版又はブランケットに対して選択的に塗布するため、湿し装置スペース内にインキング／コーティング装置１０を容易に設置することができる。さらに、フレキソ印刷用インキ及び／又はコーティングは本発明の高速・高温空気ユニット間乾燥装置及び高体積熱・水分抽出装置アセンブリによって乾燥させられるため、次の印刷ユニット上でフレキソ印刷用インキ及びコーティングのオーバープリンティングを行うことができる。

【００８４】

本発明で使用されるようなフレキソ印刷用インキ及びコーティングは、カラー顔料及び／又は可溶性染料、顔料を下地材表面上に固定するバインダ、ワックス、脱泡剤、増粘剤及び溶剤を含有する。水性印刷用インキは、希釈剤及び／又は

ビヒクルとして主として水を含有している。好ましい増粘剤には、アルゴネート、でんぷん、セルロース及びその誘導体、例えばセルロースエステル又はセルロースエーテルなどが含まれる。有機及び無機顔料を含む着色剤を、水及び溶剤中で溶けない染料から誘導することができる。適切なバインダとしては、アクリル酸エステル及び／又はポリ塩化ビニルが含まれる。

【００８５】

メタリックインキが印刷される場合、アニロックスローラのセルは、金属粒子がセル内に粘着した状態となるのを防ぐように適切にサイズ決定されてなくてはならない。例えば、メタリックゴールドインキについては、アニロックスローラは、１インチあたり１７５～３００ライン（1cmあたり６８～１１８ライン）の範囲内のスクリーンライン計数を有していなくてはならない。好ましくは、アニロックスローラセルを開けた状態に保つため、ドクターブレードアセンブリ６８には、本明細書に参考として内含されている、Howard W. DeMoore に対し譲渡され、米国テキサス州ダラスのPrinting Research Inc.にライセンス付与された、Steven M. Personに対する米国特許第５，４２５，８０９号の中で記載されているとおりの剛毛ブラシＢＲ（図１４）が具備されている。

【００８６】

インキング／コーティング装置１０は同様にＵＶ硬化型インキ及びコーティングを塗布することもできる。ＵＶ硬化型インキ及びコーティングが利用される場合、高速高温空気乾燥装置／抽出装置ユニット１２４、１２６及び１２８のそれぞれに隣接して、紫外線乾燥装置／抽出装置が設置される。

【００８７】

本明細書に記述されているＬＩＴＨＯＦＬＥＸTM印刷プロセスが、石版印刷モードで印刷機の印刷ユニットを選択的に作動させるがその一方で、同時に同じ印刷機のもう１つの印刷ユニットをフレキソ印刷モード又は乾式印刷モードのいずれかで作動させ、さらに一方で、版位置又はブランケット位置のいずれかから別々に又は同時に印刷又はコーティングするケイパビリティを提供することを可能にするものであるということがわかるだろう。本発明のデュアルクレードル支持配置は、インキング／コーティング装置１０が引込み位置にある間にアプリケー

タローラ６６を除去し、再度位置づけするか又は交換することしか必要でないため最低の印刷機動作不能時間で、ブランケット胴上でのインキング／コーティング位置から版胴上でのインキング／コーティング位置まで迅速に切替えることを可能にする。４つの押えネジをとり外し、クレードルからアプリケータローラ６６をもち上げ、それをその他のクレードル内に再度位置づけすることしか必要でない。これはすべて、印刷機からインキング／コーティング装置１０をとり外すことなく、数分で達成できる。

【００８８】

同じ印刷機の作動中、１つの印刷ユニット上でフレキシ印刷用インキ又はコーティングを用いて版位置又はブランケット位置からスポットコーティング又は全体コーティングし、次にもう１つの印刷ユニット上で版位置又はブランケット位置からＵＶ硬化型インキ又はコーティングでスポットコーティング又は全体コーティングすることが可能である。その上、印刷機オペレータは１つの業務のため版からスポット又は全体コーティングし、その後次の業務でブランケットからスポット及び／又は全体コーティングすることができる。

【００８９】

版又はブランケットに対するアプリケータローラの位置づけは、予め定められ、予めセットされた作動的位置まで反復可能である。したがって、ＬＩＴＨＯＦＬＥＸTMプロセスのためにはわずかな印刷ユニットの修正又は変更しか必要でないかもしれない。実施例に関連して自動伸長及び引込みについて記述してきたが、作動的（刷り中）位置への伸長及び非作動的（非刷り中）位置への引込みは、所望の場合手でも行うことができる。手動の態様においては、作動的（刷り中）位置で印刷機サイドフレーム１４、１５に対してインキング／コーティング装置１０をラッチし、非刷り中（引込み）位置でインキング／コーティング装置を機械的に支えることが必要である。

【００９０】

ここで再び図８を参照すると、１つのアプリケータローラ６６がサイド支持部材７８、８０によって下部クレードルアセンブリ１００上にとりつけられており、第２のアプリケータローラ６６がサイド支持部材８２、８４により上部クレー

ドルアセンブリ１０２上にとりつけられている。この配置によると、インキング／コーティング装置１０は版胴上の版に対し印刷用インキ及び／又はコーティング材料を塗布すると同時に同じ印刷ユニットのブランケット胴上の版又はブランケットに対して印刷用インキ及び／又はコーティング材料を塗布することができる。同じ色のインキが、同じ印刷ユニット上で同時に版位置及びブランケット位置から上部及び下部アプリケータローラによって使用される場合、印刷ユニットの中を下地材が一回だけ通過する間に下地材Ｓに対して「２重の衝撃（ダブル・バンプ）」つまり２重のインキングフィルム又はコーティング層が塗布される。２つのインキ又はコーティング材料のタックは、２重の衝撃の間の優れた移送を得るため相容性のあるものでなくてはならない。その上、輪転オフセット巻取紙印刷機のブランケット胴に対して、又は専用コーティングユニットのブランケットに対してインキ又はコーティング材料を塗布するためにインキング／コーティング装置１０を使用することができる。

【００９１】

従来の金付け技術に従うと、金属（青銅）粉末は予め印刷された下地材に対しオフラインで塗布され、こうして粒子が粗くテクスチュア（質感）のある仕上げ又は外観が生み出される。従来のフレキソ印刷又は石版印刷により青銅材料のオンライン塗布は、平滑で連続した外観を生成するにすぎない。しかしながら、最高の品質の印刷には粒子の粗いテクスチュアのある仕上げが好ましく、これは本発明以前はオフライン方法によってのみ生み出すことができたことである。

【００９２】

ここで図１４及び図１５を参照すると、メタリックインキ又はコーティング材料が、青銅様のテクスチュアをもつ又は粒子の粗い外観をもつ平坦でない表面仕上げを生み出すべく上部及び下部アプリケータローラ６７Ｒ、６６の同時作業により下地材Ｓに対してオンラインで塗布される。本発明のシミュレーションされた金付け方法に従うと、フレキソ印刷用ブロンズインキは、図１４に示されているようにデュアルクレードルインキング／コーティング装置１０により版及びブランケットに同時に塗布される。弾力性アプリケータローラ６７Ｒが上部クレードル１０２内にとりつけられ、アニロックスアプリケータローラ６６が下部クレ

ードル１００上にとりつけられている。ローラは別々のドクターブレードタンク７０から供給を受けている。上部クレードル位置でドクターブレードタンク７０は、水性又はフレキソ印刷用インキの中に分散させられた比較的粗い金属粒子１４０をもつブランズインキ又はコーティング材料を供給する。粗粒子インキ又はコーティング材料は上部クレードル位置１０２で弾力性アプリケータローラ６７Ｒにより版Ｐに対して塗布される。同時に、比較的細かい金属粒子１４２をもつフレキソ印刷用及び／又はブロンズインキ又はコーティング材料が、下部クレードル１００上にとりつけられたアニロックスローラ６６によってブランケットＢに移送される。

【００９３】

上部及び下部アプリケータローラの計量用表面は、金属の粗粒子及び微粒子に対応する異なるセルサイズ及び体積容量をもつ。例えば、金属粗粒子１４０を移送する上部クレードル位置１０２にとりつけられたアニロックスローラ１１１は、好ましくは1インチあたり１００～３００ライン（1cmあたり３９～１１８ライン）の範囲内のスクリーンライン計数を有し、比較的細かい金属粒子１４２を移送する下部クレードル１００上にとりつけられたアニロックスローラ６６の計量用表面は、好ましくは1インチあたり２００～６００ライン（1cmあたり７９～２３６ライン）の範囲内のスクリーンライン計数を有する。

【００９４】

版からブランケットへの移送の後、金属微粒子１４２は、金属粗粒子１４０の上に１つの層を形成する。両方の青銅層が共に下地材Ｓ上にオフセットされるにつれて、金属微粒子１４２の層は下地材Ｓ上に印刷され、金属粗粒子１４０の最上層がテクスチュアのある粒子の粗い外観を提供する。金属微粒子１４２は、その他の場合ならば金属粗粒子１４０の間の空隙の中に見えると思われる下地材をカバーする。かくして、微粒子層の上の粗粒子層の組合せは、テクスチュアのある青銅様の仕上げ及び外観を提供する。

【００９５】

金属以外の粒子状材料を、テクスチュア仕上げを生み出すのに使用することもできる。例えば、メッキされたプラスチック（光る物）の粗粒子及び微粒子、雲

母粒子（パール）などを金属粒子の代りに用いて、限りない表面変化、外観及び効果を生み出すことができる。金属粒子を含む粒状材料はすべて、好ましくは固形で平坦な小板形状をしており、アニロックスアプリケータローラによる塗布に適したサイズ寸法を有する。例えば不規則な形状及びサイズを有するストーングリットといったその他の粒子状又は粒状の材料を使用することができ、優れた利点をもたらす。

【００９６】

光をよく反射する小板形状の固体金属粒子が、青銅様の外観及び効果を生み出すのに好ましい。しかしながら、光反射特性を有し得るさまざまなテクスチュア仕上げを、ストーングリットといった粒状材料を用いて生成することができる。最も一般的に使用される金属としては、銅、亜鉛及びアルミニウムが含まれる。所望の場合には、その他の延性金属を用いることができる。さらに、粗粒子と微粒子は同じ粒子状材料で作られている必要はない。粗粒子及び微粒子のそれぞれのためにさまざまな粒子状材料を利用することによりさまざまな効果及びテクスチュアのある外観を作り出すことができる。さらに、所望の特殊な又は表面の仕上げに応じて微粒子又は粗粒子のいずれかのインキ又はコーティング材料を上部クレードル位置から印刷でき、又は微粒子又は粗粒子のいずれかのインキ又はコーティング材料を下部クレードル位置から印刷することができる。

【００９７】

石版印刷、乾式、水性及びフレキソ印刷プロセスを含む付加的なインキング／コーティングケイパビリティ用に最後の印刷ユニット２８を構成することができる、ということがわかるだろう。最後の印刷ユニット上でさまざまな下地材表面効果（例えば２重衝撃又は３重衝撃式インキング／コーティング又は金付け）を実施することができる。３重衝撃式インキング／コーティングのためには、最後の印刷ユニット２８には、図３及び図４に示されているように補助的インラインインキング又はコーティング装置９７が備わっている。インラインインキング又はコーティング装置９７は、印刷又はコーティングされたばかりのあらゆる表面の効果又は特殊処理全体にわたりさらにもう１枚のインキフィルム又はコーティング材料の保護又は装飾層を塗布して、３重衝撃を生成することを可能にする。

３重衝撃は、下地材が最後の印刷ユニットの圧胴上にある間、印刷又はコーティングされたばかりの２重衝撃の上に同時に第３のインキフィルム又はコーティング材料層を塗布することによって達成される。

【００９８】

インラインインキング／コーティング装置９７が設置される場合、紙取り胴４２からＳＵＰＥＲ　ＢＬＵＥＲ 可とう性カバリングを除去することが必要であり、同様に図３及び図４に示されているとおり、紙取り胴４２上に版又はブランケットＢをとりつけることによってインキング／コーティング作業のために紙取り胴４２を修正又は転換することも必要である。版又はブランケットＢの下には胴貼り材料が置かれ、かくして、転換された紙取り胴４２及び最後の圧胴３６上の版又はブランケットＢの間のニップを通して移送するにつれて、印刷されたばかりの下地材Ｓ上にインキ又はコーティング材料が印刷又はコーティングされるように、適正な印刷用胴貼り済み半径方向クリアランスで版又はブランケットＢが胴張りされることになる。この配置によると、印刷又はコーティングされたばかりの下地材は、インキ又はコーティング材料の第２のフィルム又は層が最後の圧胴３６上でオーバープリンティング又はオーバーコーティングされている間に同時にインキ又はコーティング材料の第３のフィルム又は層でオーバープリンティング又はオーバーコーティングされる。

【００９９】

補助的インキング／コーティング装置９７及び転換された又は修正された紙取り胴４２は、デリバリ駆動シャフト４３上にとりつけられている。インキング／コーティング装置９７は、修正された又は転換された紙取り胴４２上の版又はブランケットＢに対しインキ又はコーティング材料を供給するため、アプリケータローラ、好ましくはアニロックスアプリケータローラ９７Ａを内含する。インラインインキング／コーティング装置９７及び修正された又は転換された紙取り胴４２は好ましくは、本明細書に参考として内含されているHoward W. DeMoore(共同発明者かつ譲受人）に対する米国特許第５，１７６，０７７号の中で記述されているとおりに製造される。インラインインキング／コーティング装置９７は、米国テキサス州ダラスのPrinting Research Inc.により、その商標ＳＵＰＥＲ

ＢＬＵＥ　ＥＺ　ＣＯＡＴＥＲTMで製造・販売されている。

【０１００】

紙取り胴４２がインキング／コーティング作業のために修正又は転換された後、版又はブランケットＢにより課せられるニップクリアランスの減少のため、修正された紙取り胴４２はもはや、印刷又はコーティングされたばかりの下地材を誘導し移送するというその当初の機能を果たすことができない。その代り、修正された又は転換された紙取り胴４２は、最後の圧胴３６上で同時に印刷又はコーティングされるにつれて、印刷又はコーティングされたばかりの下地材上に３番目の下位インキフィルム又はコーティング材料の層を印刷又はコーティングすることにより、インキング／コーティング装置９７の一部として機能する。その上、第２の下位インキフィルム又はコーティング層と第３の下位インキフィルム又はコーティング層の間の相互タックのため、オーバープリンティング又はオーバーコーティングされた下地材は、版又はブランケットに粘着することになり、かくして版又はブランケットからの下地材の分離に対抗又は抵抗する。

【０１０１】

この問題を補正するため、図３及び図４に示されているように、真空を用いた移送装置９９が、修正された又は転換された紙取り胴４２に隣接してとりつけられている。真空を用いた移送装置９９のもう１つの目的は、オーバープリンティング又はオーバーコーティングを受けたばかりの３重衝撃下地材がニップの中を移送されるにつれて、版又はブランケットＢからこの下地材を分離させることにある。真空を用いた移送装置９９は、オーバープリンティング又はオーバーコーティングされたばかりの下地材がニップ内を移送するにつれてこの下地材を横切って圧力差を生成し、かくして下地材上に分離力を生み出して版又はブランケットＢからのきれいな分離を提供する。

【０１０２】

真空を用いた移送装置９９は好ましくは、本明細書に参考として内含されている、すべて共同発明者であるHoward W. DeMoore に対する米国特許第５，１１３，２５５号、５，１２７，３２９号、５，２０５，２１７号；５，２２８，３９１号；５，２４３，９０９号；及び５，４１９，２５４号で記述されているとお

りに製造される。真空を用いた移送装置９９は、米国テキサス州ダラスのPrinting Research Inc.により、その商標ＢＡＣＶＡＣTMで製造・販売されている。

【０１０３】

本発明及びその利点について詳細に記述してきたが、添付の請求項によって規定されているとおりの本発明の精神又は範囲から逸脱することなくさまざまな変化、置換及び変更を加えることができるということも理解すべきである。

【図面の簡単な説明】

【図１】

本発明を実施するインキング／コーティング装置を有する枚葉紙供給式輪転オフセット印刷機の斜視図である。

【図２】

本発明の単一ヘッド、デュアルクレードル型インキング／コーティング装置の簡略化された斜視図である。

【図３】

第１、第２及び最後の印刷ユニットの従来の湿し装置位置に設置された単一ヘッド、デュアルクレードル型インキング／コーティング装置を有する図１の印刷機の概略的側面立面図である。

【図４】

第４の印刷ユニット上の印刷版及びブランケット上に同時に印刷するための作動的インキング／コーティング位置にある単一ヘッド、デュアルクレードル型インキング／コーティング装置を示す簡略化された側面立面図である。

【図５】

第１の印刷ユニットのブランケット上へのスポット又は全体的インキング又はコーティングのために作動的位置にある単一ヘッド、デュアルクレードル型インキング／コーティング装置を示し、かつ第２の印刷ユニットの印刷版上にスポット又は全体的インキング又はコーティングを施すために作動的位置にあるデュアルクレードルインキング／コーティング装置を示す、簡略化された側面立面図である。

【図６】

ブランケット上へのスポット又は全体的コーティングのために密封されたドクターブレードタンクアセンブリをもち、作動的コーティング位置にある単一ヘッド、デュアルクレードル式インキング／コーティング装置を示す、部分的に分解された図４及び図５の単一ヘッド、デュアルクレードル型インキング／コーティング装置の簡略化された側面断面図である。

【図７】

インキング／コーティング装置に対して、温度制御されたインキ又はコーティング材料を循環させるため、単一ヘッド、デュアルクレードル型インキング／コーティング装置に連結された熱交換器及びポンプのアセンブリを示す概略図である。

【図８】

代替的なコーティングヘッド配置を例示する、図６に類似し、部分的に分解された側面立面図である。

【図９】

印刷ユニットサイドフレーム部材上のインキング／コーティング装置の旋回式結合を例示する印刷ユニットの簡略化された立面図である。

【図１０】

それぞれ上部クレードルと下部のクレードル内に一対の分割型アプリケータローラがとりつけられている、図２に類似した図である。

【図１１】

分割型アプリケータローラの側面立面図である。

【図１２】

シール要素によって中央で仕切られたドクターブレードタンクの斜視図である。

【図１３】

図１２の仕切りシール要素に対する分割型アプリケータローラの密封係合を示す断面図である。

【図１４】

インキング／コーティングの変形実施態様を例示する、図８に類似した図であ

る。

【図１５】

図１４のデュアルアプリケータローラの実施態様の同時操作により塗布される金付け様の仕上げを有する下地材の簡略化された側面立面図である。

【図１６】

分割型インキ出しパン上にとりつけられた別々の移送表面をもつパンローラの、一部断面図で表わされた側面立面図である。

【図１７】

下部クレードル上に取りつけられた単一ドクターブレードアセンブリ、アニロックスアプリケータローラを有する代替的なインキング／コーティングヘッド装置を例示する、部分的に分解されたデュアルクレードルインキング／コーティング装置の簡略化された側面立面図である。

【図１８】

別々の移送表面をもつ単一ドクターブレードアニロックスアプリケータローラアセンブリ、及び別々の外部供給源から異なるインキ又はコーティング材料の供給を受けている別々のインキ出し区画を有する分割型インキ出しパンの、部分的に断面図で表わされた側面立面図である。

【符号の説明】

１０、９７　インキング／コーティング装置

１２　印刷機

１４　印刷機フレーム

１６　枚葉紙フィーダ

２０　枚葉紙デリバリスタッカ

２２、２４、２６、２８　印刷ユニット

３０　インフィード渡し胴

３２　版胴

３４　ブランケット胴

３６　圧胴

４０　中間トランスファドラム

４２　紙取り胴

４３　デリバリシャフト

４４　デリバリコンベヤシステム

４８　デリバリ乾燥装置

５０　インキング装置

５２　インキングローラ列

５４　インキつぼ

５６　インキ出しローラ

５７　呼出しローラ

６２　油圧モータ

６６　アプリケータローラ

６８　密封型ドクターブレードアセンブリ

７０　タンク

７１　熱交換器

７４、７６　サイド支持部材

９９　移送装置

１００、１０２　クレードル

１１３　アニロックスアプリケータローラアセンブリ

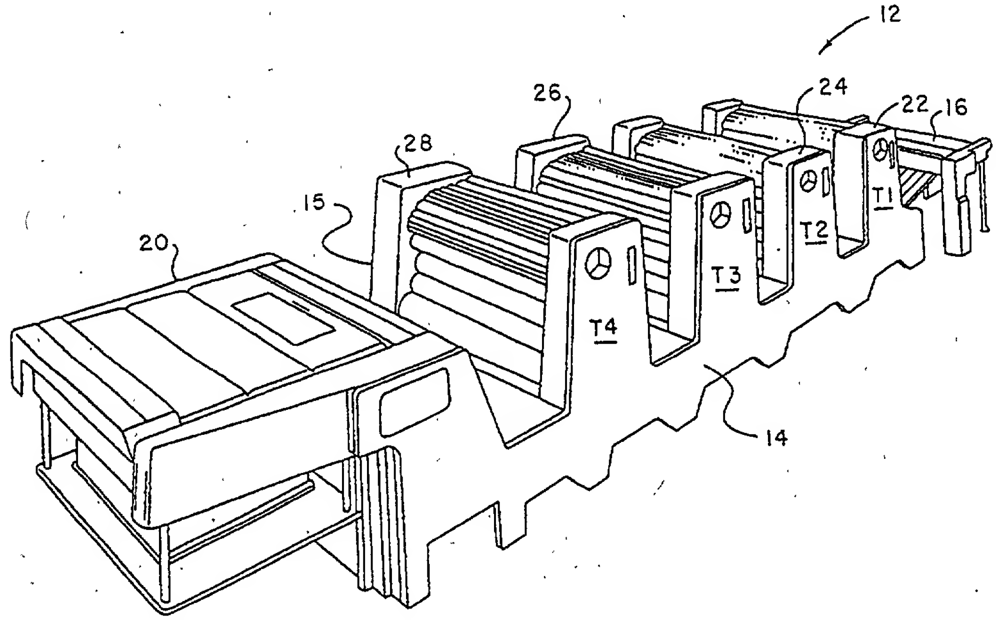
１１７　インキ出しパン

１２４、１２６、１２８　乾燥装置／抽出装置ユニット

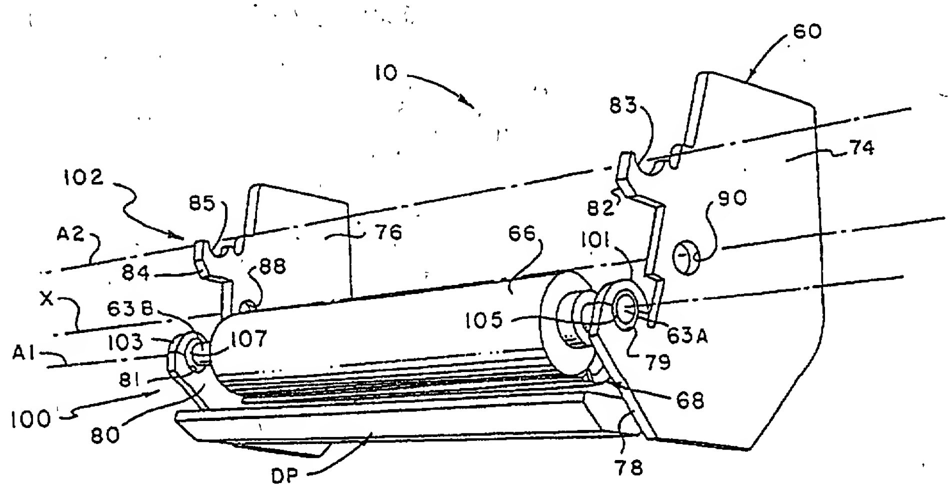
１３０　シール要素

【書類名】　図面

【図１】


12
24
22
16
26
28
15
20
T1
T2
T3
T4
14

【図２】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10
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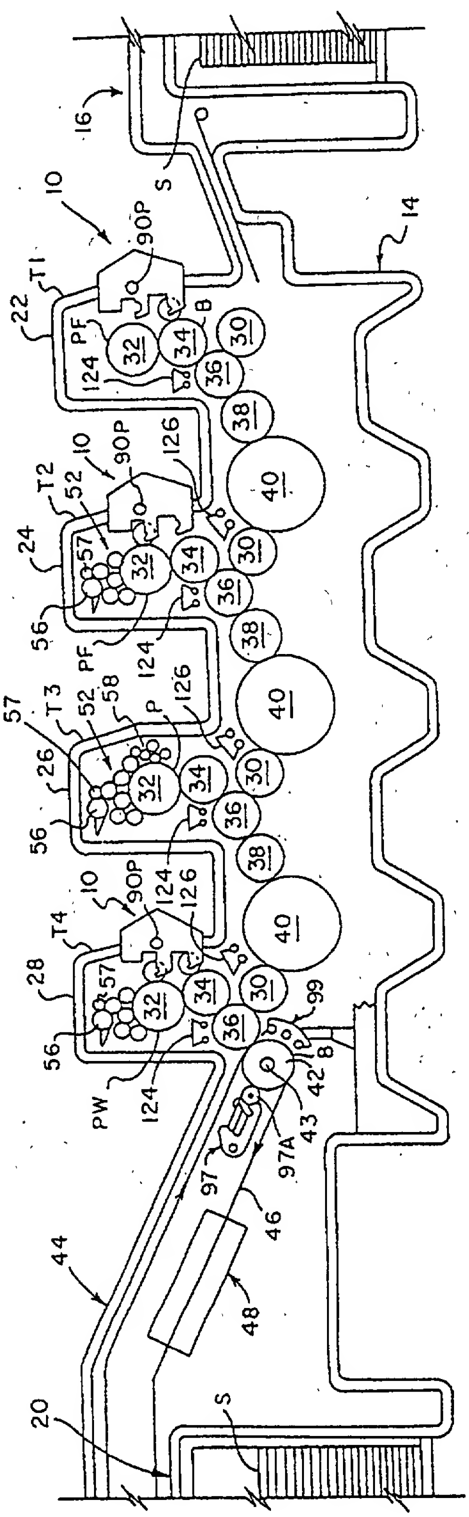
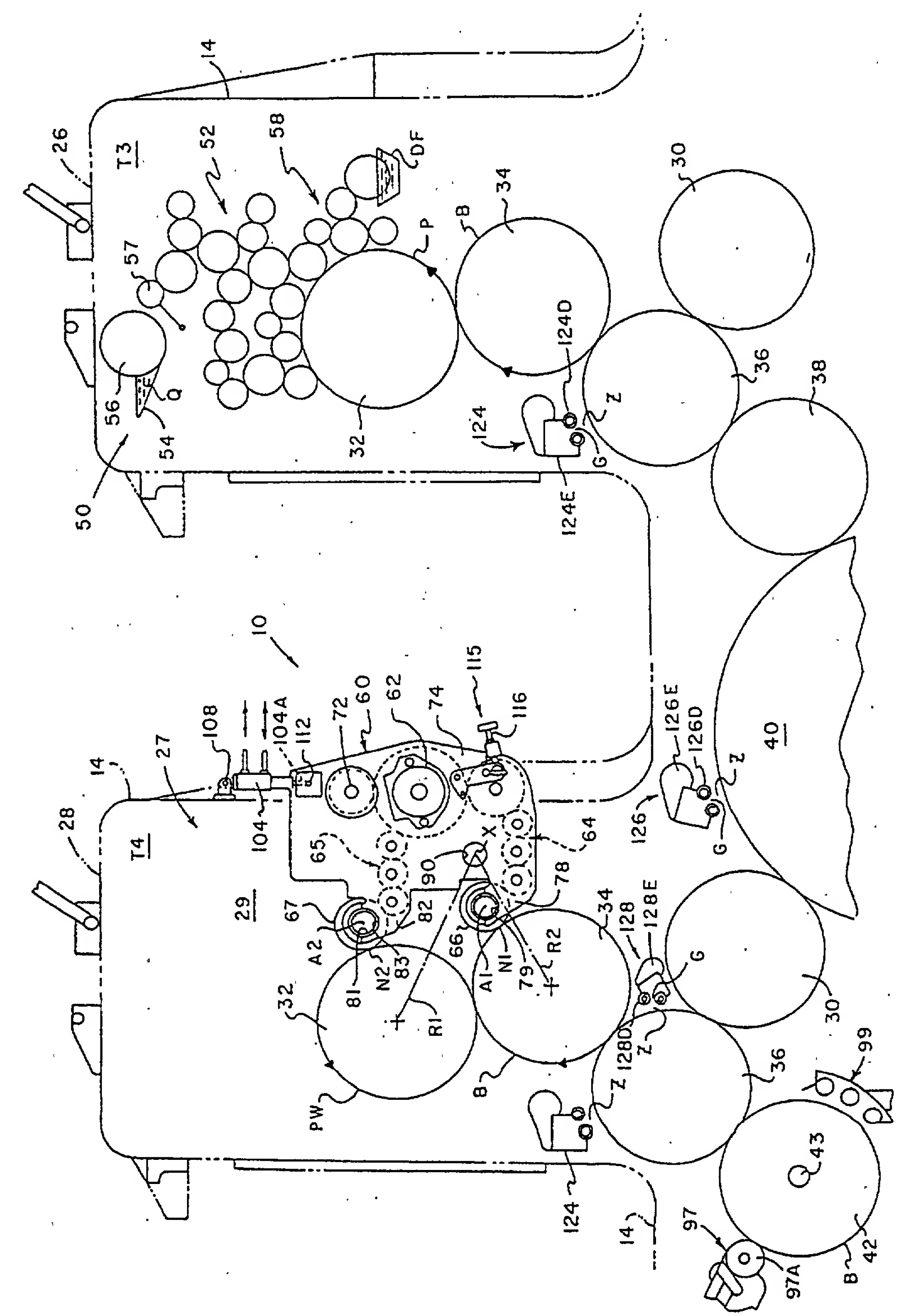
74
102
85
82
90
A2
76
66
101
84
88
X
63B
105
63A
103
107
A1
79
81
68
100
80
78
DP

【図3】


16
10
S
90P
14
T1
22
PF
124
32
34
B
30
36
38
40
126
T2
52
24
57
56
T3
58
P
26
T4
28
PW
99
8
42
43
97A
97
46
44
48
20

【図4】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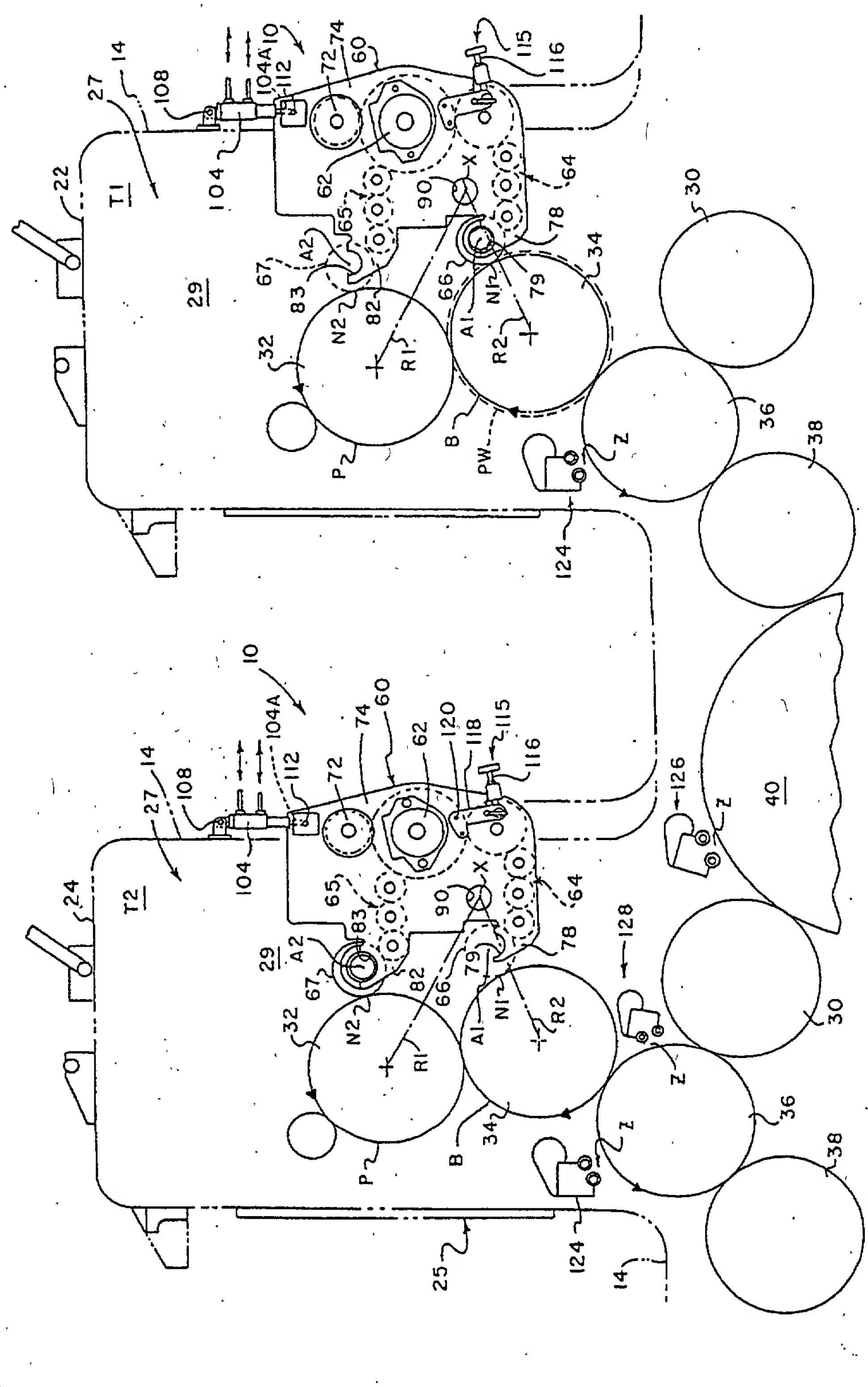
26
T3
52
58
DF
57
P
B
34
30
56
Q
54
50
32
124D
36
38
Z
124
G
124E
10
115
116
108
104A
112
72
60
62
74
27
28
T4
104
65
64
X
90
29
67
82
78
A2
83
N2
81
66
A1
N1
79
R2
R1
126E
126D
126
40
128
128E
128D
PW
99
43
97
97A
42

【図5】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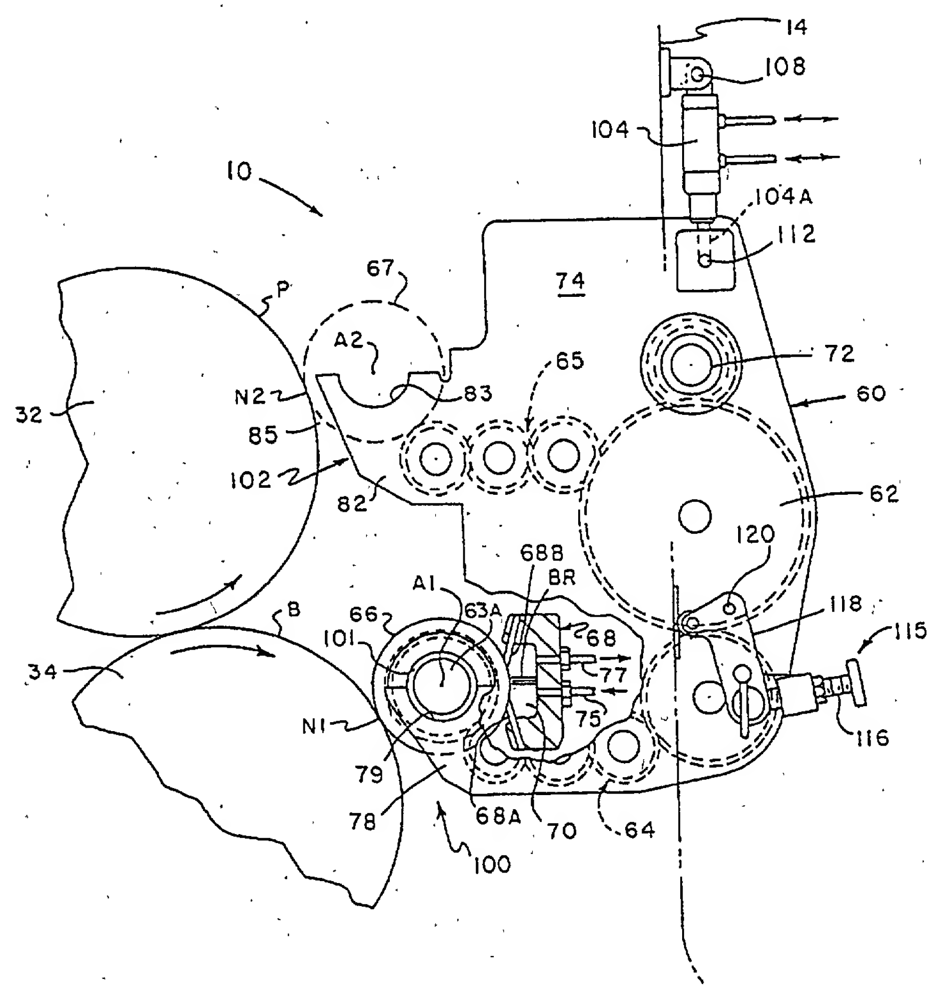
67
72
74
78
79
82
83
90
104
104A
108
112
115
116
118
120
124
126
128
T1
T2
A1
A2
N1
N2
R1
R2
X
Z
B
P
PW

【図6】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74
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A2
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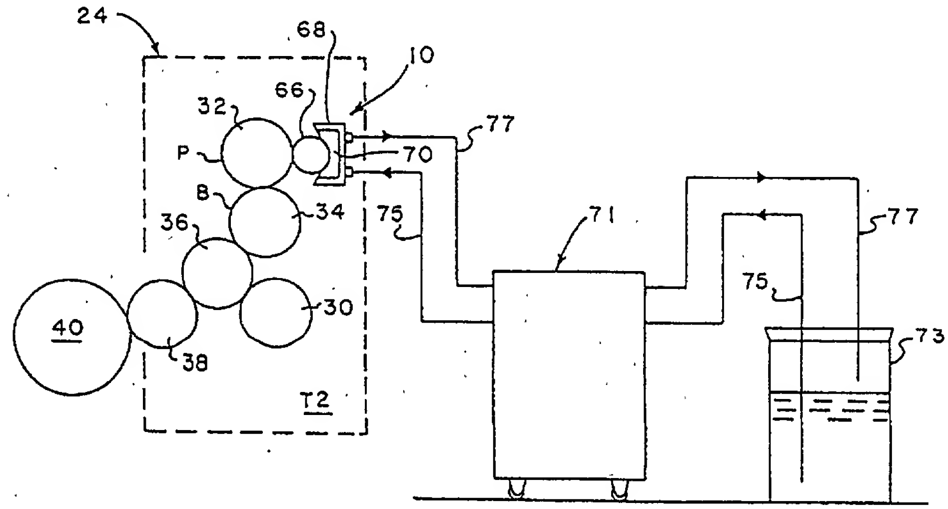
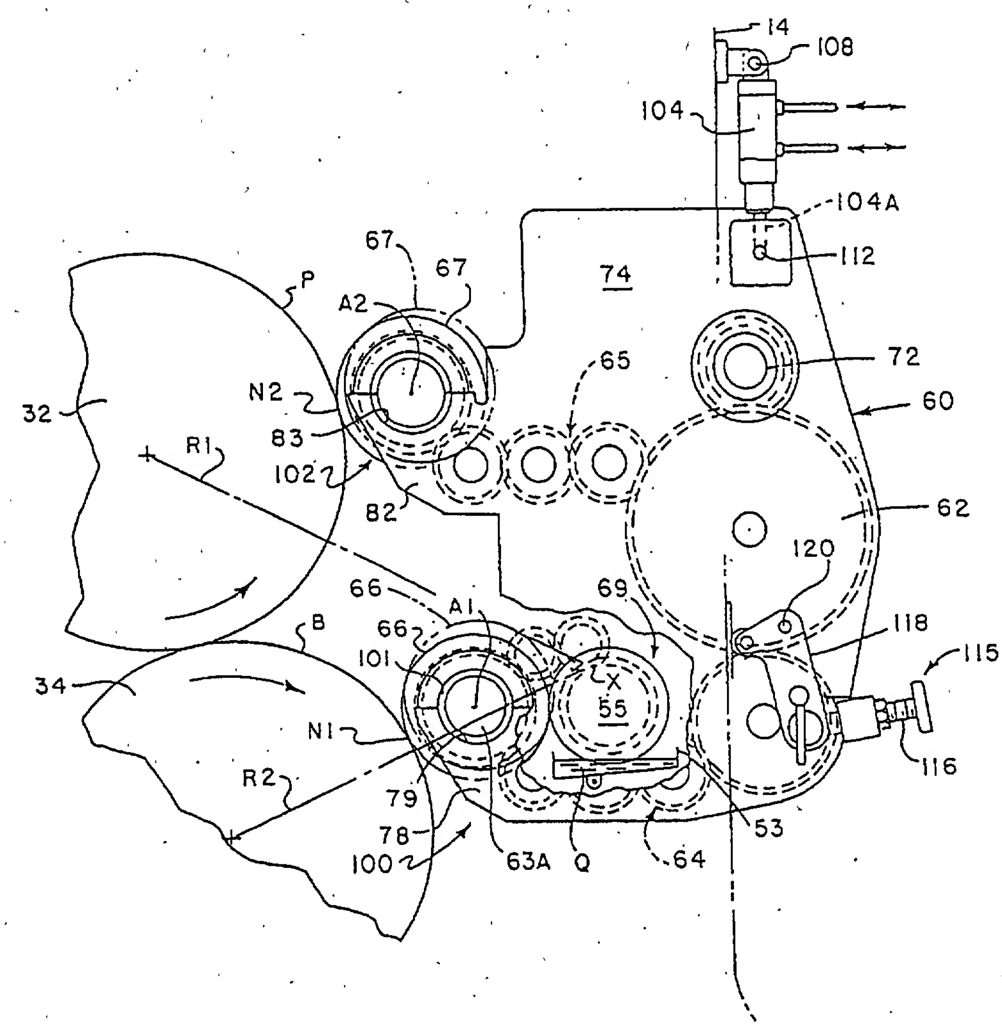
72
65
60
32
P
N2
85
102
82
62
120
A1
68B
BR
118
115
66
63A
68
B
101
77
34
75
N1
116
79
78
68A
70
64
100

【図7】



【図8】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108
104
104A
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67
67
P
A2
65
72
60
N2
32
83
R1
102
82
62
120
66
A1
69
B
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34
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N1
116
R2
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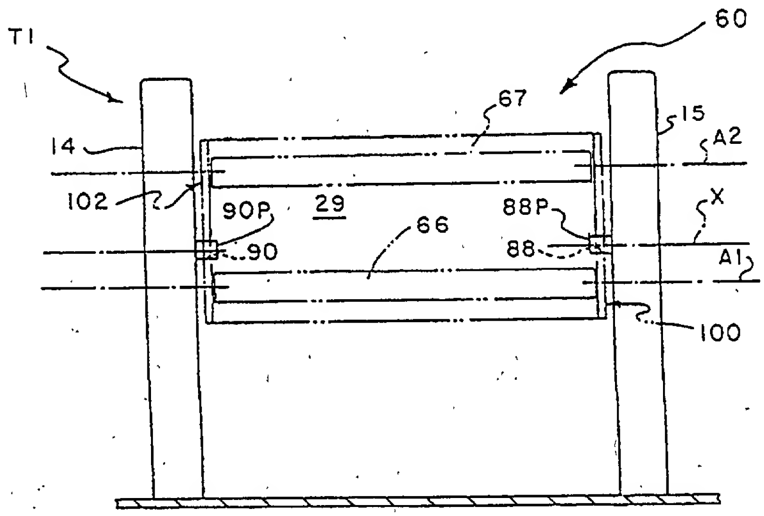
53
78
100
63A
Q
64

【図9】


T1
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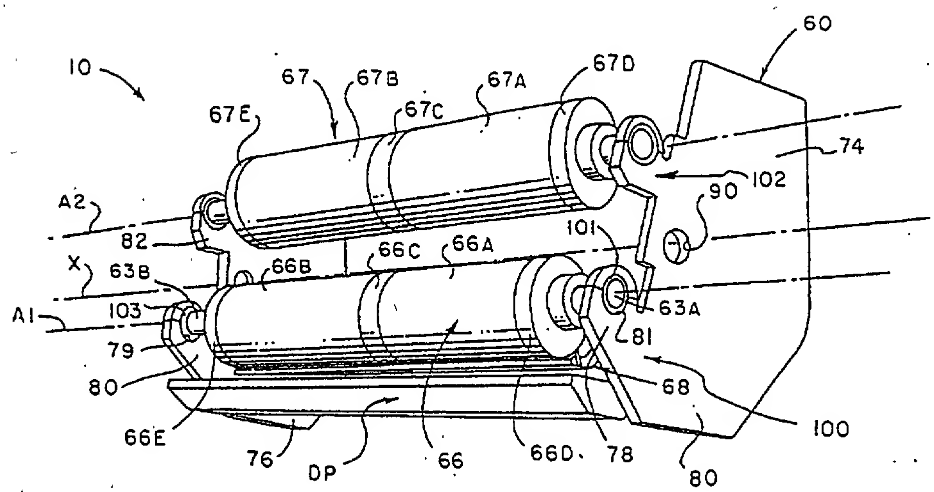
15
14
A2
102
29
X
90P
88P
66
90
88
A1
100

【図10】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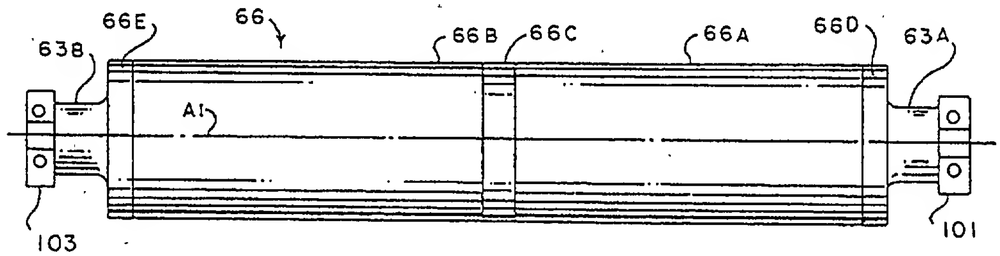
10
67
67B
67A
67D
67E
67C
74
102
90
A2
82
101
66C
66A
X
63B
66B
103
63A
A1
79
81
80
68
66E
100
76
DP
66
66D
78
80

【図１１】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66
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66C
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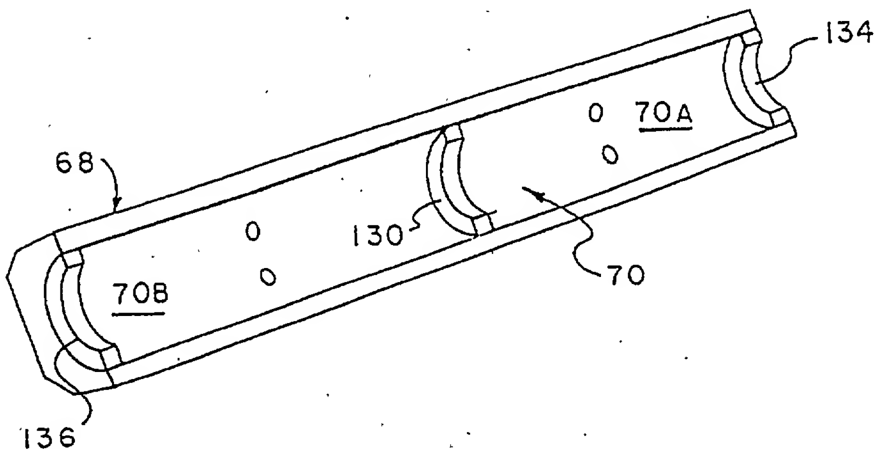
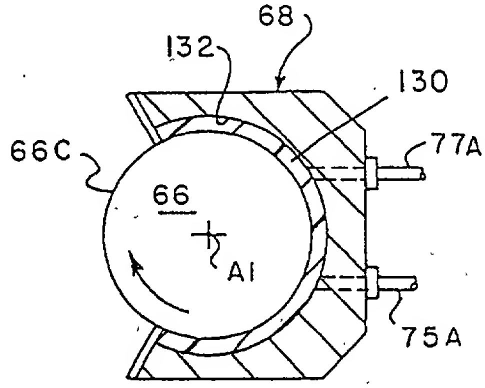
66D
63B
63A
A1
103
101

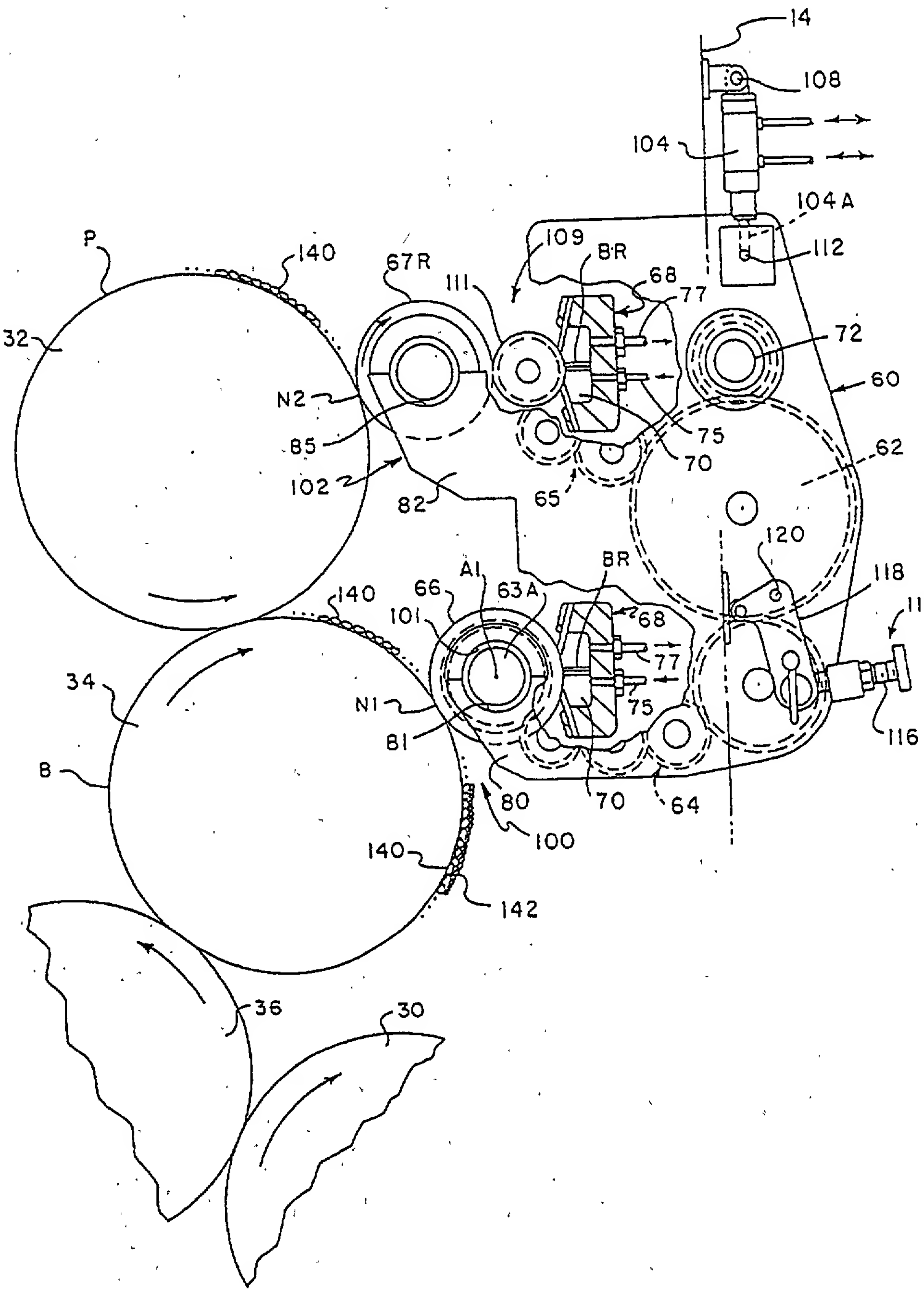
【図１２】


134
70A
68
130
70
70B
136

【図１３】



【図１４】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102
82
65
120
BR
118
66
A1
63A
68
115
140
101
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N1
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142
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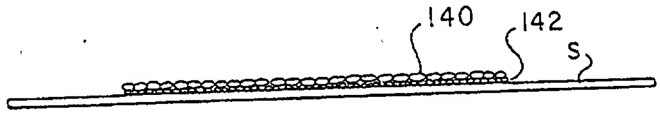
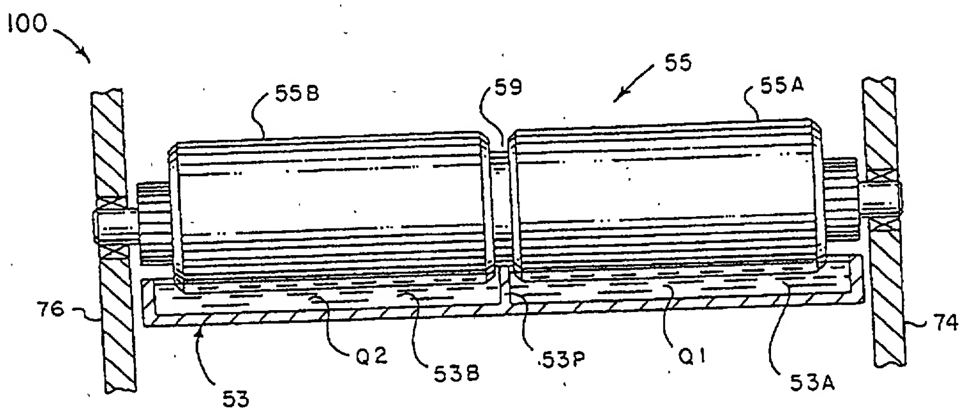
30

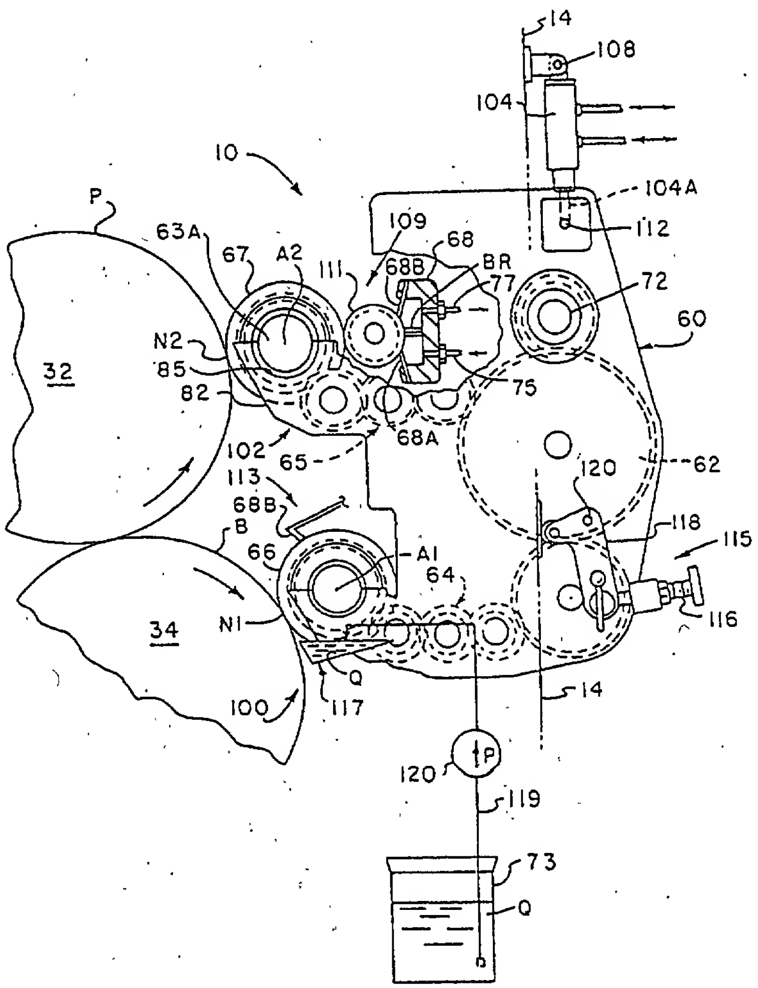
【図１５】



【図１６】



【図１７】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68A
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120
68B
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N1
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Q
100
117
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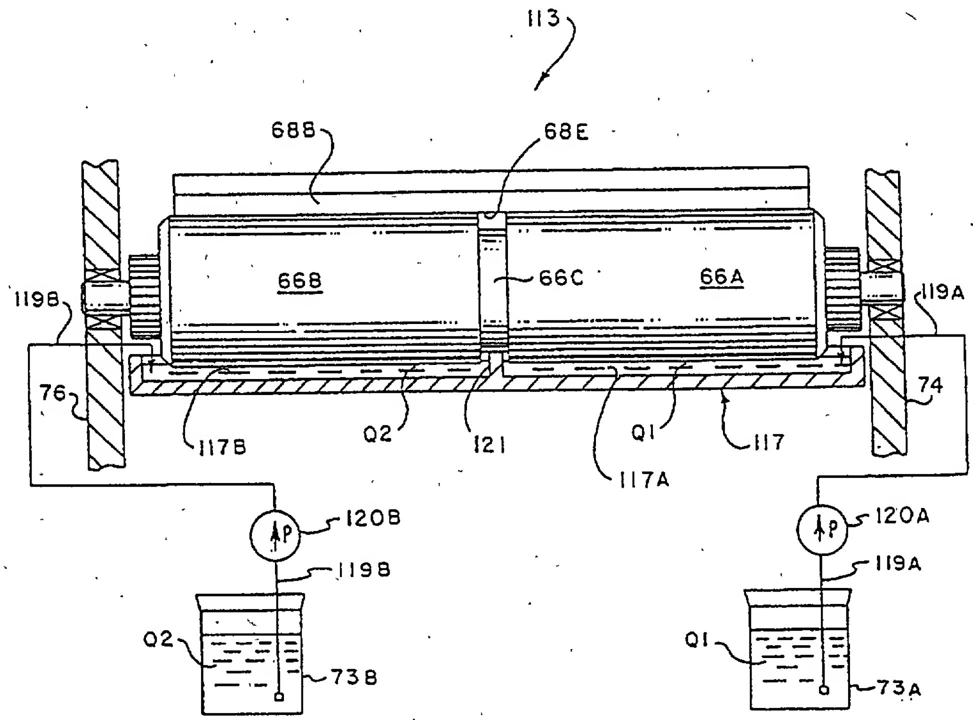
120
P
119
73
Q

【図18】


113
68B
68E
66B
66C
66A
119B
119A
76
74
117B
Q2
121
Q1
117
117A
120B
120A
119B
119A
Q2
73B
Q1
73A

【書類名】　　　要約書

【要約】

【課題】　引込み式インラインインキング／コーティング装置を備えた輪転オフセット印刷機において、その第１の印刷ユニット又はそれに続くいずれかの印刷ユニット上で版及び／又はブランケットに対し、スポットで又は全体的にインキング／コーティング材料を塗布することができるようにした。

【解決手段】　インキング／コーティング装置には、それが版胴上の版に水性／フレキソ印刷用又はＵＶ硬化型印刷用インキ又はコーティング材料の２重の衝撃を加え、それと同時にブランケット胴上の版又はブランケットに対し水性、フレキソ印刷用又はＵＶ硬化型の印刷用インキ又はコーティング材料を塗布し、その後枚葉紙がブランケット胴と圧胴の間のニップを通って移送されるにつれてこの枚葉紙上にこれを塗布できるようにした。

【選択図】　　　図５